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ABSTRACT

This curriculum guide represents the first level of a training program for hazardous materials responders. Developed as part of Arizona's certification program for hazardous materials personnel, the training is designed for emergency response personnel (fire and police), industry personnel, and emergency medical personnel. This book is divided into three parts. Part 1 contains the instructor guides for the eight-hour training. A list of the competencies/skills and tasks appears first. The guides provide information related to each specified task within the competency. The information includes competency/skill; task; performance objective and standard; student learning experiences; suggested instructional techniques; instructional equipment, materials, and supplies; and resources. The four competencies/skills relate to hazardous materials recognition and identification, safety, capabilities and limitations of first responders, and pre-emergency planning and resources. Part 2 contains lesson plans for these lessons: introduction; detecting the presence of hazardous materials; reference materials; personnel protection and safety; characteristics of hazardous materials I, II, III; planning and scene management; and summary and review. Each lesson plan includes a brief activities outline, student objectives, content outline, slide masters, handouts, related sections of the student outline, and related test questions. Part 3 is the student outline. (YLB)

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HAZARDOUS MATERIALS RESPONSE TRAINING

LEVEL I

CE 047 116

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ARIZONA CENTER FOR VOCATIONAL EDUCATION CENTER FOR EXCELLENCE IN EDUCATION
NORTHERN ARIZONA UNIVERSITY

HAZARDOUS MATERIALS RESPONSE TRAINING

LEVEL ONE

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FOREWORD

The Hazardous Materials Response Training: Level One Curriculum Guide has been developed as a part of the state's certification program for hazardous materials personnel. This training is designed for Emergency Response Personnel (Fire and Police), Industry Personnel, and Emergency Medical Personnel.

In 1984 the Arizona Division of Emergency Services, recognizing the need for competency based, standardized hazardous materials curricula, applied for funds to the Federal Emergency Management Agency and the Arizona Department of Education. With funding from these agencies, the Division began identifying and validating competencies, writing curricula and pilot testing courses. In addition, the Division sought and obtained legislative authority to set training standards, to establish standardized curricula and to certify the state's hazardous materials personnel. The LEVEL ONE CURRICULUM GUIDE represents the first level of a multi-level training program for hazardous materials responders.

The problems presented by the manufacturing, transportation, use, storage and disposal of hazardous materials are not going to disappear. Our ever-expanding technology will demand the continuing use and development of hazardous chemicals. Accidents will continue to occur and emergency responders must be prepared to handle such incidents. Arizona has taken a significant step toward insuring proper training for hazardous materials with this curriculum guide and the corresponding certification program.

ACKNOWLEDGEMENTS

The Hazardous Materials Response Training: Level One Curriculum Guide is the result of many people working together to insure quality programs through quality curriculum.

Van Summers, a Captain with the Phoenix Fire Department, wrote the technical material for the 40 hour program and developed student activities, tests and audio visuals. Van's expertise and dedication to excellence were invaluable to the curriculum development.

Sondra Lacy, an instructional designer, was able to translate innumerable pages of technical writing into curriculum format. We are grateful to Sondra for her assistance in preparing this final curriculum guide.

Terry DeMarr, a Captain with the Phoenix Fire Department, provided technical assistance in the development of the 8 hour program and was a co-instructor for all three pilot tests conducted.

Joe Baird of the Arizona Department of Education has supported the program since its inception and has provided a strong link to the educational community.

Lionel Martinez, Director of the Corporate Services Division for Maricopa County Community College District, has provided unending support, encouragement and assistance in promoting the programs, printing and audio visual development.

Chuck Monroe, a Captain with the Mesa Fire Department, and Tom Abbott, a Captain with the Tempe Fire Department, provided assistance with the editing and revieving of the 40 hour course mateirals.

Steve Storment, a Captain with the Phoenix Fire Department and Dennis O'Reilly, a Captain with the Prescott Fire Department, served as instructors for the 8 hour pilot tests.

In addition to these outstanding individuals, we are grateful to the Arizona Division of Emergency Services' Hazardous Materials Technical Advisory Committee:

Ted Blackburn
Arizona Department of
Health Services

Jim Burch
Phoenix Fire Department, retired

Ernie Freyer
Arizona Department of Public Safety

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Dennis O'Reilly
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Pima County Sheriff's Dept.

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Glendale Fire Department

Herb Hoey
Training Officer
State Fire Marshall's Office

Dennis Martin
Flagstaff Fire Department

Harold G. McCarty
Battalion Chief
Tucson Fire Department

Jerry Vanzant
Phoenix Fire Department

Bruce Weimer
Mesa Fire Department

These individuals developed the list of competencies for LEVEL ONE Hazardous Materials Responders and reviewed all phases of the program's development.

Of critical importance to this project were the Federal Emergency Management Agency and the Arizona Department of Education through the Arizona Center for Vocational Education. Without the financial support of these two agencies, this curriculum could not have been developed. We are extremely grateful to their assistance and commitment to quality training for hazardous materials responders.

Richard A. Colson, Director
Arizona Division of Emergency Services

Ethel R. Crail, Program Manager
Arizona Division of Emergency Services

We are grateful to the entire staff of the ACVE for their support, concern and assistance. Special thanks to the curriculum unit: Dr. Jerry R. Cox, Nancy F. Dillon and Cass Sandbakken.

Dr. Robert V. Kerwood
Director
Arizona Center for
Vocational Education

Don Parsons
Manager
Arizona Center for
Vocational Education

INTRODUCTION

Hazardous Materials Response Training: Level One consists of two courses. The first course is called the First Responder course and is designed to be taught in 8 hours. The second course is called the Basic Responder course and is designed to be taught in 40 hours. The First Responder course is a shortened version of the Basic Responder course; therefore, the two courses have the same competencies and tasks. Also under performance objectives the condition and evaluation are the same; the standard is written on two levels. Level one consists of the learning expectations for successful completion of the First Responder course and level two consists of the learning expectations for successful completion of the Basic Responder course.

The first part of this book contains the instructor guides for Hazardous Materials Response Training: Level One. This includes competencies, tasks and performance objectives.

The second part of this book contains the student modules for the First Responder Course (8 hours) and the third part of this book contains the student modules for the Basic Responder Course (40 hours).

STATE CERTIFICATION
OF
HAZARDOUS MATERIALS RESPONDERS

The courses contained in the HAZARDOUS MATERIALS RESPONSE TRAINING: LEVEL ONE CURRICULUM GUIDE were designed as part of the state's certification program for hazardous materials personnel.

In 1986 the Arizona legislature directed the Arizona Division of Emergency Services to set standards, to establish standardized curricula and to certify hazardous materials personnel who met the training standards.

These courses do not carry automatic state certification. Instructors must be trained and certified by the Arizona Divison of Emergency Services before certification will be awarded for this training. For more information, contact Ethel Crail, Hazardous Materials Training Program Manager, Arizona Division of Emergency Services, Phoenix, Arizona.

COMPETENCIES & TASKS	STUDENT MODULES
1. Recognition and Identification of Hazardous Materials	
1.1 Define hazardous materials and hazardous wastes.	1
1.2 Describe the D.O.T. and N.F.P.A. identification and numbering systems for hazardous materials.	2
1.3 Describe the chemical and physical properties of the major classes of hazardous materials under the U.N. - D.O.T. system.	5,6,7
1.4 Describe clues for detecting the presence of hazardous materials and prioritize them.	2
1.5 Recognize and identify the basic hazardous materials containers.	5,6,7
1.6 Evaluate the behavior of basic hazardous materials containers under types of stress, breach, release & impingement.	6,7
1.7 Identify technical reference materials for hazardous materials emergencies.	3,6,7
1.8 Demonstrate the ability to utilize the 2 major technical reference materials - the D.O.T. Emergency Response Guidebook and the N.F.P.A. Guide to Hazardous Materials	3
2. Safety Considerations	
2.1 Identify the major hazards to health and safety caused by hazardous materials.	4,5,6,7
2.2 Describe the major types of protective clothing and equipment.	4
2.3 Describe decontamination procedures.	4

3. Capabilities and Limitations of First Responders (Fire, Law, Medical, Other)

3.1	Explain the roles of first responders (police, fire, pre-hospital and hospital personnel) at the scene of a hazardous materials emergency.	1
3.2	Explain the risk assessment considerations to be made by first responders at a hazardous materials incident, with special attention to the limitations of first responders due to lack of specialized protective clothing, equipment and training.	5,6,7
3.3	Explain the implementation of a command system to assure coordination as the incident escalates.	8
3.4	Explain the rescue considerations of first responders at a hazardous materials incident.	5,6,7
3.5	Explain the evacuation considerations of first responders at a hazardous materials incident.	5,6,7
3.6	Explain the isolation and containment considerations of first responders at a hazardous materials incident.	5,6,7
3.7	Explain the environmental considerations to be made at a hazardous materials incident.	5,6,7
3.8	Describe local hazardous materials procedures.	8

4. Hazardous Materials: Pre-Emergency Planning and Resources

4.1	List in order of priority some of the major agencies available for hazardous materials emergencies in Arizona.	8
4.2	Describe pre-emergency planning for hazardous materials incidents.	8
4.3	Explain the importance of pre-emergency planning.	8

4.4 Explain the importance of coordination between multiple agencies involved in hazardous materials response. 8

4.5 Describe the correct procedures for accessing additional resources. 8

COMPETENCIES/SKILLS

COMPETENCIES/SKILLS

1. Recognition and Identification of Hazardous Materials

   1.1 Define hazardous materials and hazardous wastes.

   1.2 Describe the D.O.T. and N.F.P.A. identification and numbering systems for hazardous materials.

   1.3 Describe the chemical and physical properties of the major classes of hazardous materials under the U.N. - D.O.T. system.

   1.4 Describe clues for detecting the presence of hazardous materials and prioritize them.

   1.5 Recognize and identify the basic hazardous materials containers.

   1.6 Evaluate the behavior of basic hazardous materials containers under types of stress, breach, release & impingement.

   1.7 Identify technical reference materials for hazardous materials emergencies.

   1.8 Demonstrate the ability to utilize the 2 major technical reference materials - the D.O.T. Emergency Response Guidebook and the N.F.P.A. Guide to Hazardous Materials

2. Safety Considerations

   2.1 Identify the major hazards to health and safety caused hazardous materials.

   2.2 Describe the major types of protective clothing and equipment.

   2.3 Describe decontamination procedures.

3. Capabilities and Limitations of First Responders (Fire, Law, Medical, Other)

   3.1 Explain the roles of first responders (police, fire, pre-hospital and hospital personnel) at the scene of a hazardous materials emergency.

   3.2 Explain the risk assessment considerations to be made by first responders at a hazardous materials incident, with special attention to the limitations of first responders due to lack of specialized protective clothing, equipment and training.

3.3 Explain the implementation of a command system to assure coordination as the incident escalates.

3.4 Explain the rescue considerations of first responders at a hazardous materials incident.

3.5 Explain the evacuation considerations of first responders at a hazardous materials incident.

3.6 Explain the isolation and containment considerations of first responders at a hazardous materials incident.

3.7 Explain the environmental considerations to be made at a hazardous materials incident.

3.8 Describe local hazardous materials procedures.

4. Hazardous Materials: Pre-Emergency Planning and Resources

4.1 List in order of priority some of the major agencies available for hazardous materials emergencies in Arizona.

4.2 Describe pre-emergency planning for hazardoux materials incidents.

4.3 Explain the importance of pre-emergency planning.

4.4 Explain the importance of coordination between multiple agencies involved in hazardous materials response.

4.5 Describe the correct procedures for accessing additional resources.

1.0 COMPETENCY/SKILL:

Demonstrate the ability to recognize incidents which might involve hazardous materials and how to do a preliminary identification of these materials.

1.1 TASK:

Define hazardous materials & hazardous wastes.

PERFORMANCE OBJECTIVE:

Condition: Given the Department of Transportation (DOT) definition and 3 others,

Evaluation: accurately select the one used by the DOT.

Standard: I. The DOT definition is - "any substance or material in a quantity or form which poses an unreasonable risk to health, safety & property when transported in commerce."

II. A hazardous material is any substance which if, improperly handled, can be damaging to health or well being of man or other living organisms. Classified as: explosives, flammable gases, flammable liquids, flammable solids, oxidizers, poisons, radioactive materials, corrosives.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn the definition of hazardous materials used by the DOT.
2. Learn the definition of hazardous materials used by Ludwig Benner.
3. Learn the definition of hazardous wastes as defined in the Code of Federal Regulations (CFR).

II. 1. Learn about some of the problems facing the state & the nation in dealing with hazardous materials.
2. Learn the 8 categories of hazardous materials.

SUGGESTED INSTRUCTIONAL TECHNIQUES

I. 1. Conduct brainstorming session on definitions asking students for their ideas on what hazardous materials are.
2. Using slides, show pictures of various possible hazardous materials and discuss which ones are.
3. Present definitions used by the DOT and by Ludwig Benner.
4. Present definition of hazardous waste by CFR.

II. 1. Discuss the national dilemma & current perspectives.
2. Slide presentation on "Chemicals in the Community"
3. Slide presentation on "A Brief History of Hazardous Incidents"
4. Discuss the problems facing Arizona.
5. Present the 8 categories of hazardous materials.
6. Show videotape "Victims of Progress"

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

slides and slide projector
chalkboard or flipchart
student outline
list of acronyms

RESOURCES:

I. Code of Federal Regulations Title 49 (Department of Transportation)
Code of Federal Regulations Title 40 (Environmental Protection Agency)
AV: slides - AZ Division of Emergency Services (ADES), First Responder Course, Section 1

II. AV: slides - ADES, Basic Responder Course, section 1
videotape "Victims of Progress"-Bill McCune, Channel 5
Code of Federal Regulations Title 49 (Department of Transportation)
Code of Federal Regulations Title 40 (Environmental Protection Agency)

1.0 COMPETENCY/SKILL:

Demonstrate the ability to recognize incidents which might involve hazardous materials and how to do a preliminary identification of these materials.

1.2 TASK:

Describe the DOT and NFPA identification and numbering systems for hazardous materials.

PERFORMANCE OBJECTIVE:

Condition: Given pictures of various placards, labels and the fire diamond,

Evaluation: know what the color means on each of the 4 sections of the fire diamond and that the numbers 0-4 indicate the extent of the hazard for that chemical in that area and are used only on fixed facilities; and know that the color & number on placards and labels refers to the DOT Guide where information on that specific chemical can be found and that these are used in transportation.

Standard: I. By industry standards, colors and numbers have specific meanings which provide information on the chemical referred to.

II. DOT and NFPA systems are both very simplistic and are to be used to identify the presence of hazardous materials, not for in-depth information - they label a given material in terms of a single dangerous characteristic whereas many have more than one.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn what the 4 section of the fire diamond are and what the numbers in each section mean.
2. Learn how to read the DOT placards and labels and how to refer to the DOT Guide for information on the numbers found on each placard and label.

II. 1. Learn the weaknesses of the 2 guides and that they should be used primarily to detect the presence of hazardous materials.

SUGGESTED TEACHING TECHNIQUES:

I. 1. Using slides, explain the major sections of the fire diamond and what each color and the numbers in each mean.
2. Use slides to present examples of DOT placards & labels and explain how to read them - how to use the number found on them to look up the chemical in the DOT Guide.

II. 1. Discuss some of the weaknesses of the 2 guides.
2. Discussion of the fact that many hazardous materials have multiple hazards.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES

slide projector and screen
student outline

RESOURCES:

I. Slides: AZ Division of Emergency Services (ADES), First Responder Course, Section 2
Department of Transportation, Emergency Response Guidebook, A Guidebook for Hazardous Materials Incidents, Dept. of Transportation, Washington DC, 1984.
National Fire Protection Association, Fire Protection Guide on Hazardous Materials, 9th ed, National Fire Protection Association, Battery March Park, Mass., 1986.
Handouts: "NFPA Fire Diamond" (AZ Division of Emergency Services), "Pocket Guide for Hazardous Materials" (ADES)

II. AV: slides - ADES, Basic Responder Course, Section 2
Handouts: Multiple Hazards of Hazardous Materials,
"NFPA Fire Diamond" (AZ Division of Emergency Services),
"Pocket Guide for Hazardous Materials" (ADES)
Department of Transportation, Emergency Response Guidebook, A Guidebook for Hazardous Materials Incidents, Dept. of Transportation, Washington DC, 1984.
National Fire Protection Association, Fire Protection Guide on Hazardous Materials, 9th ed, National Fire Protection Association, Battery March Park, Mass., 1986.

1.0 COMPETENCY/SKILL:

Demonstrate the ability to recognize incidents which might involve hazardous materials and how to do a preliminary identification of these materials.

1.3 TASK:

Describe the chemical and physical properties of the major classes of hazardous materials under the UN-DOT system.

PERFORMANCE OBJECTIVE:

Condition: Given a list of the 9 major hazard categories,

Evaluation: identify at least 2 characteristics/hazards associated with each category.

Standard: I. First responders must be able to identify major characteristics of each of the classes.

II. The 9 hazard categories can be classed into 3 groups - flammable, reactive & toxic materials. First Responders should know some of the special hazards of each group of materials.

STUDENT LEARNING EXPERIENCES

I. 1. Learn the 9 major hazard categories.
2. Learn to use standard reference materials to determine major characteristics/hazards of each class of chemicals.

II. 1. Learn some of the special hazards involved in dealing with each group of hazardous materials.
2. Learn the terms flammable, combustible, flash point, ignition temperature, flammable range, specific gravity, lower explosive limit, upper explosive limit, explosive, deflagration, detonation, explosion, cryogenic, reactivity, polymerize, oxidizers, water reactive.

SUGGESTED TEACHING TECHNIQUES:

I & II.
1. Use slides to show placards of each category and discuss characteristics & hazards of each category - explosives, gases, flammables, oxidizers, organic peroxides poisons & radioactives, corrosives & other regulated materials.
2. Discuss evacuation distances.
3. Have students use DOT Guide to look up various classes and discuss what they find - hazards, protective clothing, how to detect, etc.
4. Show video clip on the Shreveport incident.
5. Conduct in-house demonstration on flammable liquids.
6. Show film entitled "BLEVE".
7. Have students do a case study on poisons.
8. Have students do a case study on corrosives.
9. Show video clip on the Santa Barbara incident
10. Show video clip on flammable incident
11. Define vocabulary words.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:
slide projector and screen
student outline

RESOURCES:

I. "Handling Hazardous Materials Transportation Emergency Course", U.S. Dept. of Transportation & National Fire Protection Assn.
"Recognizing and Identifying Hazardous Materials Course", National Fire Academy, Emmitsburg, MD, 1985.
"Hazardous Materials Incident Analysis Course", National Fire Academy, Emmitsburg, MD 1985.
Handout: "Possible Multiple Hazards" (ADES)
AV: slides - ADES First Responder Course, Sections 5,6,7
film/video - BLEVE, National Fire Protection Assn.
video clips - (Shreveport, flammables, Santa Barbara), ADES First Responder Course

II. "Handling Hazardous Materials Transportation Emergency Course", U.S. Dept. of Transportation & National Fire Protection Assn.
"Recognizing and Identifying Hazardous Materials Course", National Fire Academy, Emmitsburg, MD, 1985.
"Hazardous Materials Incident Analysis Course", National Fire Academy, Emmitsburg, MD 1985.
Handout: "Possible Multiple Hazards" (ADES)
AV: slides - ADES Basic Responder Course, Sections 5,6,7
film/video - BLEVE, National Fire Protection Assn.
video clips - (Shreveport, flammables, Santa Barbara), ADES Basic Responder Course

1.0 COMPETENCY/SKILL:

Demonstrate the ability to recognize incidents which might involve hazardous materials and how to do a preliminary identification of these materials.

1.4 TASK:

Describe the clues for detecting the presence of hazardous materials and prioritize them.

PERFORMANCE OBJECTIVE:

Condition: Given that the federal government and the DOT require specific markings and containers for hazardous materials,

Evaluation: list in order from lowest to highest risk the clues for detecting that hazardous materials are present.

Standard: I. The clues in order of priority are:

LOW
| 1. occupancy/location
R | 2. container shapes
I | 3. marking and colors
S | 4. placards & labels
K | 5. shipping papers
| 6. detection devices
| 7. senses
HIGH

II. Be able to explain each of the clues in more detail and why they are prioritized as they are.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn the 7 clues and their priority
2. Determine what occupancies in your community might contain hazardous materials.

II. 1. Learn the 3 parts of "size-up" of a situation:
What needs to be done - objectives
How can it be done - tactics
What resources are required - logistics
2. Learn more about each of the categories.
3. Learn why they are prioritized in that order.

SUGGESTED TEACHING TECHNIQUES:

I. 1. Using slides, discuss each of the 7 clues.
Discuss the priority and what that priority shows.
Show examples of each of the clues.
2. Ask students if they know which occupancies, etc. have hazardous materials in their community.

II. 1. Discuss the art of size-up.
2. Use slides to practice recognizing the presence of hazardous materials.
3. Conduct recognition exercise using slides.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES

student outline
slide projector and screen

RESOURCES:

I. "Recognizing and Identifying Hazardous Materials Course",
National Fire Academy, Emmitsburg, MD, 1985.
AV: slides - ADES First Responder Course, section 2

II. "Recognizing and Identifying Hazardous Materials Course",
National Fire Academy, Emmitsburg, MD, 1985.
AV: slides - ADES Basic Responder Course, section 2

1.0 COMPETENCY/SKILL:

Demonstrate the ability to recognize incidents which might involve hazardous materials and how to do a preliminary identification of these materials.

1.5 TASK:

Recognize and identify the basic hazardous materials containers.

PERFORMANCE OBJECTIVE:

Condition: Given examples of various types of containers,

Evaluation: identify chemicals which can be carried in each.

Standard:

I. First Responders should simply be aware that each DOT category has containers which are approved to carry those particular chemicals.

II. DOT regulates types of containers in which various materials can be transported & sets performance standards containers must meet to safely carry a specific commodity.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn that no one container can carry all hazardous materials.

II. 1. Learn some of the container types and what chemicals can be carried in each.

SUGGESTED TEACHING TECHNIQUES:

I. 1. Present the D.E.C.I.D.E. mnemonic using chalkboard to write down the meaning of each letter.
2. Discuss the fact that each DOT category has approved containers to carry these chemicals.

II. 1. Discuss DOT regulations for containers and discuss some of the types of containers & what chemicals they can carry.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

student outline
slide projector and screen

RESOURCES:

I. "Recognizing and Identifying Hazardous Materials Course", National Fire Academy, Emmitsburg, MD, 1985.
"Handling Hazardous Materials Transportation Emergencies Course", U.S. Dept. of Transportation & National Fire Protection Assn.
"Hermann, Steve, Hazardous Materials Transportation Accidents Illustrated.
AV: slides - ADES, First Responder Course, sections 5,6,7

II. AV: slides - ADES, Basic Responder Course, Section 5,6,7
"Recognizing and Identifying Hazardous Materials Course", National Fire Academy, Emmitsburg, MD, 1985.
"Handling Hazardous Materials Transportation Emergencies Course", U.S. Dept. of Transportation & National Fire Protection Assn.
"Hermann, Steve, Hazardous Materials Transportation Accidents Illustrated.

1.0 COMPETENCY/SKILL:

Demonstrate the ability to recognize incidents which might involve hazardous materials and how to do a preliminary identification of these materials.

1.6 TASK:

Evaluate the behavior of basic hazardous materials containers under types of stress, breach, release & impingement.

PERFORMANCE OBJECTIVE:

Condition: Given 3 examples of different types of containers,

Evaluation: describe the probable behavior of that container if it should fail.

Standard: I. To understand what a BLEVE is, how it occurs, how to prevent it and how to deal with one if it occurs.

II. To understand that there are different ways that containers can fail depending on what type of container it is and what it is carrying.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn to recognize compressed gas containers, how they fail and the results of such a failure.

II. 1. Learn some of the basic container shapes, what types of chemicals are found in each and what behavior (dangers) each pose.

SUGGESTED TEACHING TECHNIQUES:

I. Use slide to show compressed gas containers and discuss the failure of these containers and the resultant BLEVE if they do fail.

II. 1. Use slides to show various containers and discuss the probable behavior of each should it begin to fail.
2. Show the film "BLEVE"
3. Show video clip on anhydrous ammonia explosion in Shreveport.
4. Show video clip on Santa Barbara incident

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

student outline
slide projector & screen
film projector

RESOURCES:

I. "Recognizing and Identifying Hazardous Materials Course", National Fire Academy, Emmitsburg, MD, 1985.
"Handling Hazardous Materials Transportation Emergencies Course", U.S. Dept. of Transportation & National Fire Protection Assn.
Hermann, Steve, Hazardous Materials Transportation Accidents Illustrated.
AV: film - BLEVE, NFPA
Student Modules - ADES First Responder Course, Sections 5,6,7.

II. "Recognizing and Identifying Hazardous Materials Course", National Fire Academy, Emmitsburg, MD, 1985.
"Handling Hazardous Materials Transportation Emergencies Course", U.S. Dept. of Transportation & National Fire Protection Assn.
Hermann, Steve, Hazardous Materials Transportation Accidents Illustrated.
AV: film - BLEVE, NFPA
Student Modules - ADES Basic Responder Course, Sections 5,6,7

1.0 COMPETENCY/SKILL:

Demonstrate the ability to recognize incidents which might involve hazardous materials and how to do a preliminary identification of these materials.

1.7 TASK:

Identify technical reference materials for hazardous materials emergencies.

PERFORMANCE OBJECTIVE:

Condition: Given a typical hazardous materials incident,

Evaluation: identify the major reference books that any hazardous materials response group would be familiar with.

Standard: I. The 2 basic reference books that any first responder should carry with them are - DOT Emergency Response Guidebook and NFPA Guide to Hazardous Materials. These reference books should be carried with first responders at all times & they should be able to look up information quickly in them. Discuss MSDS sheets & provide examples.

II. Other major reference sources are: Bureau of Explosives Emergency Handling of Hazardous Materials in Surface Transportation and Computer Data Bases such as CHEMTREC

STUDENT LEARNING EXPERIENCES:

I. 1. Learn the names of the 2 major reference materials carried by first responders.
2. Use each of the books to become familiar with the information found in each.
3. Know the 4 sections of the fire diamond and how to read the information found there; know what information is found on the DOT placards; know how to look up this information in the 2 reference sources.
4. Know where to look if you fail to identify a material by either its name or number.
5. Be familiar with Material Safety Data Sheets (MSDS).

II. 1. Learn about some of the Computer Data Bases available.
2. Learn how to contact CHEMTREC
3. Learn something about the Bureau of Explosives manual.

SUGGEST INSTRUCTIONAL TECHNIQUES:

I. 1. Pass out copies of both books to each student or small group of students.
2. Present the various sections of each of the 2 reference books and what information is found in each.
3. Have students practice looking up information in each.

II. 1. Discuss the Bureau of Explosives manual.
2. Discuss computer data bases, especially CHEMTREC and how to call for information.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

student outline
slide projector and screen

RESOURCES:

I & II. slides - DOT "Standard References for Identifying Hazardous Materials"
slides - NFPA "Standard References for Identifying Hazardous Materials"
slides - Other Reference Sources "Standard References for Identifying Hazardous Materials"
Department of Transportation, Emergency Response Guidebook, A Guidebook for Hazardous Materials Incidents, Dept. of Transportation, Washington DC, 1984.
National Fire Protection Association, Fire Protection Guide on Hazardous Materials, 9th ed, National Fire Protection Assn, Battery March Park, Mass., 1986.
State of Arizona, Occupational Safety and Health Standards for General Industry, 29 CFR Part 1910 (1910.1200 Hazard Commission).
Handouts: "NFPA Fire Diamond", ADES

1.0 COMPETENCY/SKILL:

Demonstrate the ability to recognize incidents which might involve hazardous materials and how to do a preliminary identification of these materials.

1.8 TASK:

Demonstrate the ability to use the 2 major technical reference materials - the DOT Emergency Response Guidebook & the NFPA Guide to Hazardous Materials.

PERFORMANCE OBJECTIVE:

Condition: Given specific chemicals,

Evaluation: use the 2 major reference sources to research these chemicals.

Standard: I & II. First responders should be able to use the 2 reference books to look up basic information on any hazardous material encountered.

STUDENT LEARNING EXPERIENCES:

I & II. 1. Learn how to use and interpret Material Safety Data Sheets.
2. Learn how to use the DOT and NFPA Guides to look up information.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Using slides and the 2 reference books, have students practice looking up information on specified chemicals.
2. Help students work their way through the various sections of the 2 books.
3. Discuss the use of Material Safety Data Sheets
4. Have students get into groups and fill out a MSDS using the 2 reference sources.

II. 1. Have students practice using the 2 reference guides.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

student outline
Material Safety Data Sheets

RESOURCES:

I. Department of Transportation, Emergency Response Guidebook, A Guidebook for Hazardous Materials Incidents, Dept. of Transportation, Washington DC, 1984.
National Fire Protection Association, Fire Protection Guide on Hazardous Materials, 9th ed, National Fire Protection Assn, Battery March Park, Mass., 1986.
Handout: student activity, ADES First Responder Course, Section 3.

II. Department of Transportation, Emergency Response Guidebook, A Guidebook for Hazardous Materials Incidents, Dept. of Transportation, Washington DC, 1984.
National Fire Protection Association, Fire Protection Guide on Hazardous Materials, 9th ed, National Fire Protection Assn, Battery March Park, Mass., 1986.
Handout: student exercise "Researching Hazardous Materials", ADES, Basic Responder Course, section 3.

2.0 COMPETENCY/SKILL:

Demonstrate an understanding of how hazardous materials can harm you and how to follow good rules of safety during incidents involving hazardous materials.

2.1 TASK:

Identify the major hazards to health & safety caused by hazardous materials.

PERFORMANCE OBJECTIVE:

Condition: Given a list of the 9 major categories of hazardous materials & a DOT Guide,

Evaluation: identify 4 ways hazardous materials can invade your body.

Standard: I. The 4 ways are:
absorption
inhalation
ingestion
injection

II. To further determine the main mechanisms of harm the mnemonic TRACEM is often used.
TRACE stands for -
T - thermal
R - radiation
A - asphyxiation
C - chemical
E - etiological
M - mechanical

STUDENT LEARNING EXPERIENCES:

I. 1. Learn how to use the major reference sources to look up the health & safety hazards of a particular chemical.
2. Learn the locations of the major & the local medical facilities.
3. Learn the 4 ways hazardous materials invade the body: absorption, inhalation, ingestion & injection.

II. 1. Learn the mnemonic TRACEM and identify what each letter stands for.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Discuss how to use reference materials to determine health & safety factors at an emergency.
2. Have students look up a chemical and discuss what they find on health hazards of that chemical.
3. Discuss poison centers and medical facilities available locally and/or in the state.
4. Have students get into groups & use a case study to discuss initial actions & rescue considerations.
5. Discuss the 4 ways hazardous materials invade the body - inhalation, absorption, ingestion & injection using slides.

II. 1. Discuss the mnemonic TRACEM and how it helps identify the main mechanisms of harm which can occur when exposed to hazardous materials.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

student outline
chalkboard or flipchart
slide projector & screen

RESOURCES:

I. Student Modules - ADES First Responder Course, Section 4
AV: slides, ADES First Responder Course, Section 4

II. Student Modules - ADES Basic Responder Course, Section 4
AV: slides, ADES Basic Responder Course, Section 4

2.0 COMPETENCY/SKILL:

Demonstrate an understanding of how hazardous materials can harm you and how to follow good rules of safety during incidents involving hazardous materials.

2.2 TASK:

Describe the major types of protective clothing & equipment.

PERFORMANCE OBJECTIVE:

Condition: Given the fact that the safety of the user is the number 1 priority,

Evaluation: describe what full protective clothing is, what special protective clothing is, & in what situations each would be worn.

Standard: I. To understand some of the varieties of protective clothing and that no one suit of clothing is available for all situations.

II. Know when to use breathing apparatus, types of breathing apparatus, the 2 types of protective clothing & the 3 ways protective clothing can fail.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn what kinds of clothing and equipment have been found to be most useful and in what situations.
2. Learn some rules for evaluating new types of protective clothing & equipment that are constantly being developed.
3. Learn to always make safety the major priority in determining the use of protective clothing.

II. 1. The 3 ways protective clothing can fail are: degradation, penetration, permeation.
2. Types of breathing apparatus: filter masks, re-breathers & SCBA.
3. 2 types of protective clothing are: full & special.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Use slides to show some of the clothing & equipment available.
2. Bring examples of clothing to class & discuss quality and cost.
3. Show slides of various injuries sustained when protective clothing was not used.
4. Discuss 4 ways chemicals can invade the body & relate to use of protective clothing & equipment.
5. Show NFPA slide/tape program "Protective Clothing for Hazardous Materials."

II. 1. Discuss the safe utilization of breathing apparatus.
2. Identify the various types of protective clothing.
3. Identify the equipment needs for first responders & for hazardous materials response teams.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

protective clothing
slide projector & screen
student outline

RESOURCES:
Student Modules - ADES First Responder Course, Section 4
AV: slides - ADES First Responder Course, Section 4
slide/tape - "Protective Clothing for Hazardous Materials Incidents", National Fire Protection Assn.

2.0 COMPETENCY/SKILL:

Demonstrate an understanding of how hazardous materials can harm you and how to follow good rules of safety during incidents involving hazardous materials.

2.3 TASK:

Describe decontamination procedures.

PERFORMANCE OBJECTIVE:

Condition: Given that safety is the major priority,

Evaluation: list the 6 steps of simple decontamination for any responders or victims who have been exposed to a hazardous material.

Standard:

I. The 6 steps are -
   1. Remove all clothing.
   2. Use copious amounts of water.
   3. Contain water for proper disposal.
   4. Do not allow victims to be transported until decontaminated.
   5. Decontaminate equipment, vehicles, protective clothing, etc.
   6. Notify medical centers.

II. Understand the difference between simple decontamination and the full decontamination procedure - establishment of a decontamination zone, separation of decon stations, supporting decon effort & securing the zone.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn the appropriate steps in decontamination.
   2. Learn location of major & local medical facilities.
   3. Learn location of poison control centers.

II. 1. Learn how decontamination can occur.
   2. Learn what simple decontamination is and what full decontamination requires.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Use slides to show how to set up a decontamination area.
2. Use slides to show how to separate victims, what clothing to wear, how to remove victims.
3. Use slides to show the use of dying.

II. 1. Define simple decontamination.
2. Outline and discuss the decontamination process.
3. Student exercise - Performing decontamination.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

slides
slide projector & screen
student outline

RESOURCES:

I. Student Modules - ADES First Responder Course, Section 4
AV: slides - ADES First Responder Course, Section 4

II. AV: slides - ADES Basic Responder Course, section 4.

3.0 COMPETENCY/SKILL:

Analyze a specific hazardous materials incident in order to determine what you as a first responder are capable of doing and what your limitations are due to a lack of training, equipment & protective clothing.

3.1 TASK:

Explain the roles of first responders (police, fire, pre-hospital & hospital personnel) at the scene of a hazardous material emergency.

PERFORMANCE OBJECTIVE:

Condition: Given that police, fire & medical workers are usually the first responders at a hazardous materials incident,

Evaluation: list responsibilities & attitudes of these first responders.

Standard:

I. The 8 major responsibilities are:
   1. Establish command
   2. Detect the presence of hazardous materials
   3. Begin identification
   4. Evacuation
   5. Decontamination/personnel protection
   6. Isolate the incident
   7. Contain the incident
   8. Seek additional appropriate resources.

II. Essential attitudes are:
   1. Hazardous materials calls are not routine. They can be extremely complex & dangerous.
   2. Each responders must be realistic about capabilities & limitations.
   3. Primary responsibility of first responder is safety of all concerned.
   4. First responders must coordinate activities of other agencies.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn the 4 objectives for this course.
   2. Learn the 8 basic responsibilities of first responders.

II. 1. Learn the 4 essential attitudes that will enhance decision-making & actions of first responders at the scene.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Show slides on overview of the problem.
2. Discuss responsibilities of first responders
3. Discuss what first responders need to know: recognition & identification, safety considerations, capabilities & limitations, pre-emergency planning.
4. Discuss essential attitudes for first responders.
5. Show video "First on the Scene".
6. Show slides - "A Brief History of Hazardous Materials Incidents".
7. Use newspaper clippings of recent events to highlight the scope of the problem.

II. 1. Discuss course content for the 40 hour course.
2. Show slides - "Chemical in the Community".

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

overhead projector & screen
student outline
VCR & monitor
slide projector

RESOURCES:

I. Student Modules - ADES First Responder Course, Section 1.
Handout : State of Arizona, Hazardous Materials First Responder Minimum Competencies and Skills (ADES)
AV: slides - ADES First Responder Course, Section 1
video - "First on the Scene", Chemical Manufacturers Assn.

II. Student Modules - ADES Basic Responder Course, Section 1.
AV: slides - ADES Basic Responder Course, Section 1

3.0 COMPETENCY/SKILL:

Analyze a specific hazardous materials incident in order to determine what you as a first responder are capable of doing and what your limitations are due to a lack of training, equipment & protective clothing.

3.2 TASK:

Explain the risk assessment considerations to be made by first responders at a hazardous materials incident, with special attention to the limitations of first responders due to lack of specialized protective clothing, equipment & training.

PERFORMANCE OBJECTIVE:

Condition: Given a hazardous materials incident,

Evaluation: describe the 3 levels of response capability depending on amount of training, equipment & protective clothing.

Standard:

I. The 3 levels of response capability are:
   1. first responder
   2. intermediate
   3. advanced

II. First Responder Capabilities
   a. establish command
   b. detect presence of hazardous materials
   c. recognize hazards & begin identification
   d. evacuation
   e. personnel protection
   f. decontamination
   g. isolate incident/identify zones of activity
   h. contain incident if possible without risk
   i. seek additional resources

Intermediate Level Capabilities
   a. hazard materials sectoring
   b. tentative identification
   c. site entry
   d. temporary confinement
   e. documentation

Advanced Level Capabilities
   a. sector review & revision
   b. specialized research & identification confirmation
   c. specialized containment
   d. decontamination
   e. command function

STUDENT LEARNING EXPERIENCES:

(Note: This task will be taught in sections consisting of the 9 hazard categories. Refer to units 5,6 & 7.)

I. 1. Learn the 3 levels of response capability and what training, equipment & protective clothing are required for each level.

II. 1. Learn some of the functions of each of the 3 levels.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Using slides, describe & list the amount of training, equipment & protective clothing required for each level of response capability.

II. 1. Discuss Incident Analysis.
2. Discuss some of the capabilities & limitations of each of the 3 levels of response.

INSTRUCTIONAL MATERIALS, EQUIPMENT & SUPPLIES

student outline
slide projector & screen

RESOURCES

I. "Hazardous Materials Incident Analysis Course", National Fire Protection Academy, Emmitsburg, MD, 1985.
Handout: State of Arizona, "Hazardous Materials Tiered Response Concept"
AV: slides - ADES First Responder Course, Section 8

II. "Hazardous Materials Incident Analysis Course", National Fire Protection Academy, Emmitsburg, MD, 1985.
Handout: State of Arizona, "Hazardous Materials Tiered Response Concept"
AV: slides - ADES Basic Responder Course, Section 8

3.0 COMPETENCY/SKILL:

Analyze a specific hazardous materials incident in order to determine what you as a first responder are capable of doing and what your limitations are due to a lack of training, equipment & protective clothing.

3.3 TASK:

Explain the implementation of a command system to assure coordination as the incident escalates.

PERFORMANCE OBJECTIVE:

Condition: Given a hazardous materials incident,

Evaluation: list the actions to be taken en route to an incident & the actions to be taken at the scene.

Standard:

I. En route
   1. life hazards? (conditions at the scene, what is the product?)
   2. review pre-emergency planning
   3. additional resources needed?

   At the Scene
   1. take control
   2. size up
   3. routing & positioning
   4. additional resources

II. Additional resources should be called for to:
   1. isolate the area
   2. secure the scene & deny entry
   3. evacuate surrounding area if necessary
   4. rescue, decontaminate & treat victims
   5. protect property & environment

STUDENT LEARNING EXPERIENCES:

I. 1. Learn what a command system is & why it is important.
   2. Learn what sectorization is & describe how it works.
   3. Learn what initial actions to take enroute to a call.

II. 1. Learn the functions of a "hazardous sector".

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Identify initial actions of first responders at a hazardous incident.
2. List responsibilities of Command at the scene of a chemical mishap.
3. Describe the functions of sectors in managing an emergency call.

II. 1. Describe the functions of a "hazardous sector" at a hazardous materials call.
2. Student exercise - "Setting the stage".
3. Student exercise - "Establishing control".
4. Student exercise - "Providing sectorization".
5. Student exercise - "Putting it all together".

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

slide projector & screen
student outline

RESOURCES:

I. Student Modules - ADES First Responder Course, Section 8
AV: slides - ADES First Responder Course, Section 8

II. Student Modules - ADES Basic Responder Course, Section 8.
AV: slides - ADES Basic Responder Course, Section 8.

3.0 COMPETENCY/SKILL:

Analyze a specific hazardous materials incident in order to determine what you as a first responder are capable of doing and what your limitations are due to a lack of training, equipment & protective clothing.

3.4 TASK:

Explain the rescue considerations of first responders at a hazardous materials incident.

PERFORMANCE OBJECTIVE:

Condition: Given a hazardous materials incident,

Evaluation: describe some of the factors to consider before attempting to rescue victims.

Standard:

I. Rescue must only be attempted if it can be done safely - rescuers must not themselves become victims.

II. Learn to use the standard reference sources to look up information to assist in determining rescue of victims.

STUDENT LEARNING EXPERIENCES:

I & II. 1. Learn how to look up a chemical in standard reference sources and use the information found to determine rescue of victims - it is sometimes not safe for first responders to attempt to rescue victims.

2. Know where local medical facilities are located & what types of injuries they can handle.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Use slides to show examples of incidents in which rescue of victims is in question - discuss situations in which rescue may not be advisable.
2. Discuss rescue considerations: rescuer protection, victim protection, decontamination.

II. 1. Discuss rescue consideration in terms of the various hazard categories.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

slide projector & screen
student outline

RESOURCES

I. Student Modules - ADES First Responder Course, Sections 5,6,7.
AV: slides - ADES First Responder Course, Sections 5,6,7.

II. Student Modules - ADES Basic Responder Course, Sections 5,6,7.
AV: slides - ADES Basic Responder Course, Sections, 5,6,7.

3.0 COMPETENCY/SKILL:

Analyze a specific hazardous materials incident in order to determine what you as a first responder are capable of doing and what your limitations are due to a lack of training, equipment & protective clothing.

3.5 TASK:

Explain the evacuation considerations of first responders at a hazardous materials incident.

PERFORMANCE OBJECTIVE:

Condition: Given examples of various chemicals,

Evaluation: look up evacuation distances for various chemicals in the DOT Guide.

Standard:

I. Flammable liquids pose the greatest danger to rescuers & evacuation procedures should be followed immediately upon arriving at the scene.

II. First responders must learn to be realistic about their capabilities & limitations - learn to evacuate & isolate danger areas especially when resources are limited.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn how to use reference sources to determine evacuation distances for various chemicals.

II. 1. Learn about the dangers involved in incidents involving flammable liquids.
2. Learn the importance of assessing one's limitations & that evacuation is sometimes the best action to take especially in incidents involving flammable liquids.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Discuss using the DOT Guide to look up evacuation distances at the same time as using the Guide to look up characteristics.
   2. Have students use the DOT Guide to practice looking up some examples.

II. 1. Show the film "BLEVE".
   2. Discuss the special hazards of flammable liquids and the need to evacuate and isolate in such cases.
   3. Student exercise - 'Decision-making for flammable liquids'

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

student outline
slide projector & screen
film projector

RESOURCES:

I. Student Modules - ADES First Responder Course, Sections 5,6,7.
AV: slides - ADES First Responder Course, Sections 6
Department of Transportation, Emergency Response Guidebook, A Guidebook for Hazardous Materials Incidents, Dept. of Transportation, Washington DC, 1984.

II. Student Modules - ADES Basic Responder Course, Sections 5,6,7.
AV: slides - ADES Basic Responder Course, Sections 6
Department of Transportation, Emergency Response Guidebook, A Guidebook for Hazardous Materials Incidents, Dept. of Transportation, Washington DC, 1984.

3.0 COMPETENCY/SKILL:

Analyze a specific hazardous materials incident in order to determine what you as a first responder are capable of doing and what your limitations are due to a lack of training, equipment & protective clothing.

3.6 TASK:

Explain the isolation and containment considerations of first responders at a hazardous materials incident.

PERFORMANCE OBJECTIVE:

Condition: Given examples of various chemicals in the major hazard categories,

Evaluation: describe the steps to be taken to isolate & contain the hazard to avoid escalation of the incident.

Standard:

I. Using the standard reference sources, look up isolation & containment information on any given chemical.

II. Flammable liquids pose the greatest danger to rescuers & first responders must learn to be realistic about their limitations & understand that isolating a flammable liquid may be the best course of action when resources are limited.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn to use standard reference sources to determine how to isolate & contain a specific chemical or combination of chemicals.

II. 1. Learn some of the special hazards of flammable liquids and understand that isolating and containing these liquids may be the best course of action.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Use slides to show examples of incidents & discuss how to isolate & contain.
   2. Use DOT Guide & NFPA Guide to look up various chemicals and determine isolation & containment.

II. 1. Show the film 'BLEVE'.
   2. Discuss some of the special hazards of flammable liquids and the need to isolate and contain.
   3. Student exercise - 'Decision-making for flammable liquids'.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

student outline
film projector
slide projector & screen

RESOURCES:

I. Student Modules - ADES First Responder Course, Sections 5,6,7
   AV: slides - ADES First Responder Course, Sections 5,6,7
   Department of Transportation, Emergency Response Guidebook, A Guidebook for Hazardous Materials Incidents, Dept. of Transportation, Washington DC, 1984.
   National Fire Protection Association, Fire Protection Guide on Hazardous Materials, 9th ed. National Fire Protection Assn, Battery March Park, Mass., 1986.

II. Student Modules - ADES Basic Responder Course, Sections 5,6,7
   AV: slides - ADES Basic Responder Course, Sections 5,6,7
   Department of Transportation, Emergency Response Guidebook, A Guidebook for Hazardous Materials Incidents, Dept. of Transportation, Washington DC, 1984.
   National Fire Protection Association, Fire Protection Guide on Hazardous Materials, 9th ed. National Fire Protection Assn, Battery March Park, Mass., 1986.

3.0 COMPETENCY/SKILL:

Analyze a specific hazardous materials incident in order to determine what you as a first responder are capable of doing and what your limitations are due to a lack of training, equipment & protective clothing.

3.7 TASK:

Explain the environmental considerations to be made at a hazardous materials incident.

PERFORMANCE OBJECTIVE:

Condition: Given examples of various chemicals,

Evaluation: describe how the environment could be affected & what steps should be taken to minimize damage.

Standard:

I. Be aware that sometimes actions by first responders can actually increase damage to the environment.

II. Use standard reference sources to look up possible environmental damage of any given chemical.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn to use standard reference materials to look up ways a particular chemical or combination of chemicals can impact the environment.

II. 1. Learn methods to contain environmental pollution especially for flammable liquids.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Use slides to show examples of incident & discuss the environmental impact.
   2. Use standard reference materials & have students practice looking up information on various chemicals & how they impact the environment.

II. 1. Show the film "AFFF".
    2. Discuss foam and flammable liquids.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

student outline
slide projector & screen

RESOURCES:

I. Student Modules - ADES First Responder Course, Sections 5,6,7.
AV: slides - ADES First Responder Course, Sections 5,6,7.
Department of Transportation, Emergency Response Guidebook, A Guidebook for Hazardous Materials Incidents, Dept. of Transportation, Washington DC, 1984.
National Fire Protection Association, Fire Protection Guide on Hazardous Materials, 9th ed. National Fire Protection Assn, Battery March Park, Mass., 1986.

II. Student Modules - ADES Basic Responder Course, Sections 5,6,7.
AV: slides - ADES Basic Responder Course, Sections 5,6,7.
Department of Transportation, Emergency Response Guidebook, A Guidebook for Hazardous Materials Incidents, Dept. of Transportation, Washington DC, 1984.
National Fire Protection Association, Fire Protection Guide on Hazardous Materials, 9th ed. National Fire Protection Assn, Battery March Park, Mass., 1986.

3.0 COMPETENCY/SKILL:

Analyze a specific hazardous materials incident in order to determine what you as a first responder are capable of doing and what your limitations are due to a lack of training, equipment & protective clothing.

3.8 TASK:

Describe local hazardous materials procedures.

PERFORMANCE OBJECTIVE:

Condition: Given an individual local community,

Evaluation: list 5 questions that community should ask itself in developing a local plan for handling a hazardous materials emergency.

Standard: I. The 5 questions are:
1. What chemicals are used, stored or moved thru my community? Where are they?
2. How are the chemicals contained, transported and stored? In what quantity?
3. How are the chemicals used?
4. What routes of travel are used? What is the frequency of movement?
5. What can these chemicals affect if there is unintentional release?

II. How to write a plan:
1. Decide on the kind of plan needed.
2. Review prior plans.
3. Identify functions of emergency response or support groups.
4. Identify comprehensive emergency responsibilities.
5. Coordinate with industry.
6. Identify deficiencies.
7. Interface & coordinate with existing plans.
8. Identify problem areas.
9. Decide who will write the plan.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn how to develop a local plan - what steps to take
2. Learn the 4 critical elements of a pre-emergency plan: warning, communication, evacuation/shelter, & clean-up

II. 1. Develop an action plan for own community or agency.

SUGGESTED TEACHING TECHNIQUES

I. 1. Discuss the 5 questions to ask in developing a local plan - using slides.
2. Suggest students visit fixed facilities using & storing hazardous materials & develop a plan for each in case a response is required.
3. Given students handout on local fire & police dept. hazardous materials procedures.

II. 1. Have each student develop an action plan for hazardous materials planning in their agency and/or community. Have student share their ideas and plan.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:
student outline

RESOURCES:

I. Student Modules - ADES First Responder Course, Section 8
Handouts: Local procedures (ADES)

II. Student Modules - ADES Basic Responder Course, Section 8

4.0 COMPETENCY/SKILL:

Evaluate the hazardous materials and available resources in your community and formulate plans for dealing with a possible incident involving hazardous materials.

4.1 TASK:

List in order of priority some of the major agencies available for hazardous materials emergencies in Arizona.

PERFORMANCE OBJECTIVE:

Condition: Given a hazardous materials emergency,

Evaluation: list 4 major agencies to contact including the agency which should be contacted first and the phone number of that agency.

Standard: I & II. The 4 major agencies in order of priority are -

1. Fire Department/Police Department (911)
2. Department of Public Safety
3. Department of Health Services
4. Department of Emergency Services

STUDENT LEARNING EXPERIENCES:

I & II.
1. Learn 4 of the major agencies in the state of Arizona that could become involved in a hazardous materials emergency.
2. Learn the name and phone number of the primary responsible agency in Arizona which should be contacted for state resources.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I & II.
1. Give students a list of the agencies including phone numbers.
2. Discuss under what situations each agency could become involved in a hazardous materials emergency.
3. Emphasize that they memorize the phone number of the Duty Officer at the DPS for state & federal resources.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

student outline

RESOURCES:

I. State of Arizona, "Hazardous Materials Emergency Response Plan" (ADES)
AV: slides - ADES First Responder Course, Section 8
Student Modules - ADES First Responder Course, Section 8

II. State of Arizona, "Hazardous Materials Emergency Response Plan" (ADES)
AV: slides - ADES Basic Responder Course, Section 8
Student Modules - ADES Basic Responder Course, Section 8

4.0 COMPETENCY/SKILL:

Evaluate the hazardous materials and available resources in your community and formulate plans for dealing with a possible incident involving hazardous materials.

4.2 TASK:

Describe pre-emergency planning for hazardous materials incidents.

PERFORMANCE OBJECTIVE:

Condition: Given information on the resources available in a particular community,

Evaluation: list the elements involved in pre-emergency planning.

Standard:

I. The 2 steps involved in pre-emergency planning are: hazard analysis & resource identification. The benefits of a hazard analysis are:
   1. Know what to expect
   2. Set goals & priorities
   3. Make decisions about resources & budgets
   4. Identify level of commitment

II. The 5 questions for a hazard analysis are:
   1. What chemicals are used, stored or moved thru my community? Where are they?
   2. How are the chemicals contained, transported & stored? In what quantity?
   3. How are the chemicals used?
   4. What routes of travel are used? What is the frequency of movement?
   5. What can these chemicals affect, & how, if if there is an unintentional release?

STUDENT LEARNING EXPERIENCES:

I. 1. Learn the 4 benefits of a hazard analysis.

II. 1. Learn the terms - hazard, vulnerability, risk
    2. Learn the 5 questions for a hazard analysis.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 2. Using overhead transparencies, discuss the 5 steps to doing a hazard analysis.

II. 1. Student activity - "Locating Hazardous Materials in Your Community".
2. Lecture with slides - hazard analysis

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

student outline
slide projector & screen

RESOURCES:

I. "Analysis of Hazardous Materials Emergencies for Emergency Program Managers", Federal Emergency Management Agency, 1985.
Student Modules - ADES First Responder Course, Section 8.
AV: slides - ADES First Responder Course, Section 8.

II. "Analysis of Hazardous Materials Emergencies for Emergency Program Managers", Federal Emergency Management Agency, 1985.
Student Modules - ADES Basic Responder Course, Section 8.
AV: slides - ADES Basic Responder Course, Section 8.

4.0 COMPETENCY/SKILL:

Evaluate the hazardous materials and available resources in your community and formulate plans for dealing with a possible incident involving hazardous materials.

4.3 TASK:

Explain the importance of pre-emergency planning.

PERFORMANCE OBJECTIVE:

Condition: Given a hazardous materials emergency in your community,

Evaluation: list at least 3 reasons why a pre-emergency plan is so important.

Standard:

I. 1. To identify possible threats to the community.
2. To identify potential resources available.
3. To identify who would be in charge & how to contact them.

II. 1. To coordinate response among agencies.
2. To become aware of any emergency plans already in existence.
3. To become aware of liabilities of first responders & of any possible legal actions.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn why pre-emergency planning is so important.
2. Learn the basic ingredients of pre-emergency planning.

II. 1. Learn how to do pre-emergency planning for occupancies.
2. Learn what is involved in the planning process.
3. Learn how to identify resources available.
4. Learn about possible evacuation procedures.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Discuss hazard analysis and resource identification in connection with pre-emergency planning.
2. Learn who to contact in case of emergencies.

II. 1. Student activity - develop a form or checklist to use for inspecting an occupancy. Discuss in class.
2. Discuss how to develop pre-emergency plans for occupancies.
3. Discuss identification of resources in the community.
4. Student activity - identify resources required for all 4 phases of hazardous materials management. Identify the sources of the resources listed.
5. Discuss dealing with the media and the possibility of evacuation.
6. Discuss the planning process.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

VCR & TV
slide projector & screen
student outline

RESOURCES:

I. Student Modules - ADES First Responder Course, Section 8.
AV: slides - ADES First Responder Course, Section 8.

II. Student Modules - ADES Basic Responder Course, Section 8.
AV: slides - ADES Basic Responder Course, Section 8.
video - Mississaugua Incident

4.0 COMPETENCY/SKILL:

Evaluate the hazardous materials and available resources in your community and formulate plans for dealing with a possible incident involving hazardous materials.

4.4 TASK:

Explain the importance of coordination between multiple agencies involved in hazardous materials response.

PERFORMANCE OBJECTIVE:

Condition: Given an example of a hazardous materials incident,

Evaluation: list the steps of a comprehensive emergency management program.

Standard:
I. A comprehensive emergency management program consists of 4 phases: mitigation, preparedness, response & recovery.
II. Integrated Emergency Management Systems include combining the 4 phases of comprehensive emergency management with the coordination of all involved agencies.

STUDENT LEARNING EXPERIENCES:

I. 1. Learn the 4 phases of CEM.

II. 1. Learn what an Integrated Emergency Management System consists of.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Discuss the 4 phases of comprehensive emergency management.

II. 1. Student activity - use the 4 phases of IEMS to prepare a plan for a chemical storage facility in your community. Divide students into groups to complete this activity. Discuss when they complete it.
2. Using slides, discuss IEMS.

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

student outline
overhead projector & screen

RESOURCES:

I. "Analysis of Hazardous Materials Emergencies for Emergency Program Managers", Federal Emergency Management Agency, 1985.
Student Modules - ADES First Responder Course, Section 8.
AV: slides - ADES First Responder Course, Section 8.

II. "Analysis of Hazardous Materials Emergencies for Emergency Program Managers", Federal Emergency Management Agency, 1985.
Student Modules - ADES Basic Responder Course, Section 8.
AV: slides - ADES Basic Responder Course, Section 8.

4.0 COMPETENCY/SKILL:

Evaluate the hazardous materials and available resources in your community and formulate plans for dealing with a possible incident involving hazardous materials.

4.5 TASK:

Describe the correct procedures for accessing additional resources.

PERFORMANCE OBJECTIVE:

Condition: Given a hazardous materials incident,

Evaluation: describe the procedure (size-up) to be used in determining resources available and what resources might be additionally needed.

Standard:

I. Size-up consists of:
   1. objectives
   2. tactics
   3. strategy

II. Tactics & Strategy consist of:
   1. Events analysis
   2. Establishing command
   3. Staging
   4. Communications
   5. Safety

STUDENT LEARNING EXPERIENCES:

I. 1. Learn the steps to be taken in performing size-up during an emergency incident.

II. 1. Learn the value of events analysis.
   2. Learn the relationship between a Command structure & the utilization of tactics & strategy.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

I. 1. Identify the steps to be taken in performing size-up.
   2. Student exercise - "Performing size-up".

II. 1. Discuss the value of events analysis.
   2. Discuss the relationship between a Command structure & the utilization of strategy and tactics.
   3. Student exercise - "Estimating outcome".
   4. Student exercise - "Establishing the structure".

INSTRUCTIONAL EQUIPMENT, MATERIALS & SUPPLIES:

student outline
slide projector & screen

RESOURCES:

I. State of Arizona, "Hazardous Materials Emergency Response Plan" (ADES)
   Student Modules - ADES First Responder Course, Section 8.
   AV: slides - ADES First Responder Course, Section 8.

II. State of Arizona, "Hazardous Materials Emergency Response Plan" (ADES)
   Student Modules - ADES Basic Responder Course, Section 8.
   AV: slides - ADES Basic Responder Course, Section 8.
   Handout: "Identifying Priorities"

LESSON PLANS
FOR

HAZARDOUS MATERIALS RESPONSE TRAINING
LEVEL ONE:

FIRST RESPONDER COURSE
(8 HOURS)

I. INTRODUCTION

A. Introduction of students and faculty (30 min.)

B. Pretest (25 min.)

BREAK (10 min.)

C. Overview (5 min.)

D. Objectives (5 min.)

E. Definitions (15 min.)

STUDENT OBJECTIVES - MINIMUM COMPETENCIES/SKILLS

1.1 Define hazardous materials.

3.1 Explain the roles of police, fire, pre-hospital & hospital personnel at the scene of a hazardous materials emergency.

I. INTRODUCTION

A. Introduction of students and faculty (30 min.)

1. Welcome students. Explain state hazardous materials training program and certification.

2. Introduce faculty.

3. Ask students to introduce themselves and to identify their professions. Ask students to identify their role at the scene of a hazardous materials incident. Ask if their community and/or work place has a plan which identifies the roles of responders in the area. Be sure to emphasize the various types of agencies which might be involved in hazardous materials incidents and emphasize the need for training for all the various entities. Be sure to mention that others besides responders may be "first on the scene." For example, truck drivers, chemical industrial workers may truly be first at the scene of a hazardous materials accident.

4. Hand out student outline, student packets. Explain use of student outline. Explain sign in sheet - please print.

B. Explain the reasons for administering a pretest.

1. to allow students to measure the increase in their knowledge of hazardous materials
2. to provide a measure of instructor effectiveness
3. pretest will alert students to key points of course

C. Hand out pretest. Allow 30 minutes for students to complete the test.

Give students a 10 minute break at the end of the test.
DO NOT WRITE ON THE TESTS ! !

D. Overview (5 min.) with slides

Explain that:

1. Hazardous materials are everywhere - nationally and in Arizona. (slide #1)

2. An estimated 1-1/2 billion tons of hazardous materials are transported throughout the nation annually. (slide #2)

3. Resulting in thousands of accidents. (slide #3)

4. An estimated 2 million tons (122,314 truckloads) of hazardous materials enter Arizona annually. (slide #4)

5. Whether these materials are transported, stored or processed, the potential for an unintentional release exists. (slide #5)

6. And these releases can have disasterous emergencies. (slide #6)

Slides of incidents. (slides #7-11)

(Instructor may wish to develop an overhead transparency of recent newspaper reports of hazardous materials emergencies)

E. Objectives (5 min.) with slides

1. A recent study by the Office of Technology Assessment stated that three-fourths of the nation's responders are inadequately trained to respond to hazardous materials incidents.

2. Explain that before you become involved in a hazardous materials incident, you need to understand your role & how you may have a positive effect on the outcome. You need to know how not to become part of the problem.

3. Explain that this course will not make you a "hazardous materials expert." It will help you become part of the solution, not part of the problem. (slide #13)

4. This course will concentrate on the basic responsibilities of first responders. (slide #14)

   a. Establish command/control (scene management).
   b. Detect the presence of hazardous materials.
   c. Begin identification.
   d. Evacuation.
   e. Decontamination/personnel protection.
   f. Isolate incident/identify zones of activity.
   g. Contain incident if possible from an isolated position without risk of exposure.
   h. Seek additional appropriate resources.

5. So that you may perform your role effectively, we have identified the following objectives for this course: (slide #15) (see handout)

   a. Recognition and identification.
   b. Safety considertions.
   c. Capabilities and limitations of first responders.
   d. Pre-emergency planning.

6. In addition to these objectives, there are also "essential attitudes" which are critical for safety. (slide #16)

   a. Hazardous Materials Incidents are not like routine calls.

   b. Every responder must be realistic about capabilities and limitations.

   c. The primary responsibility of every first responder is to promote safety for all.

   d. Coordinate and cooperate with all agencies responding to hazardous materials incidents.

F. Definitions (15 min.) with slides

1. Ask students to explain what the words "hazardous materials" mean to them. Use flip chart or chalkboard to record responses.

2. Develop a working definition of hazardous materials from the students' answers. The definition should include the key elements of the following:

   a. "any substance or material in a quantity or form which poses an unreasonable risk to health, safety and property when transported in commerce." (slide #17)

      U.S. Department of Transportation

   b. "any substance that jumps out at you when something goes wrong and hurts or harms the things it touches" (slide #18)

      Ludwig Benner
      (former Chief Hazardous Materials
      Investigator for National
      Transportation Safety Board)

   A hazardous material is any substance that has destructive potential if allowed to escape the controlled confinement of a container or manufacturing process, or if it is utilized in a manner that is contrary to accepted practice to the manufacturer's specifications. Thus, there are many chemicals that have the potential to injure or kill for one reason or another, but it takes an unfit container or an unsafe act to create the conditions by which potential harm can become a destructive force.

3. Define "hazardous waste." (slide #19)

   Hazardous waste means any waste or combination of wastes which pose a substantial present or potential hazard to human health or living organisms because such wastes are nondegradable or persistent in nature or because they can biologically magnify or because they can be lethal or because they may otherwise cause or tend to cause detrimental cumulative effects.

   Code of Federal Regulations
   Title 40. Part 261
   Environmental Protection Agency

(slide)

"FIRST RESPONDER" RESPONSIBILITIES AND CAPABILITIES

1. Establish command/control (scene management)
2. Detect the presence of hazardous materials.
3. Begin identification.
4. Evacuation.
5. Decontamination/personnel protection
6. Isolate incident/identify zones of activity.
7. Contain incident if possible without risk of exposure to response personnel in standard protective clothing.
8. Seek additional, appropriate resources.

(slide)

COURSE OBJECTIVES

1. Recognition and Identification.
2. Safety Considerations.
3. Capabilities and Limitations of First Responders.
4. Pre-emergency Planning.

(Handout)

MINIMUM COMPETENCIES/SKILLS FOR HAZARDOUS MATERIALS FIRST RESPONDERS

1. Recognition and Identification of Hazardous Materials

   1.1 Define "Hazardous Materials".

   1.2 Describe the D.O.T. and N.F.P.A. identification and numbering systems for hazardous materials.

   1.3 Describe the chemical and physical properties of the major classes of hazardous materials under the U.N. - D.O.T. system.

   1.4 Describe clues for detecting the presence of hazardous materials.

   1.5 Recognize and identify the basic hazardous materials containers.

   1.6 Evaluate the behavior of basic hazardous materials containers under types of stress, breach, release, and impingement.

   1.7 Identify technical reference materials for hazardous materials emergencies.

   1.8 Demonstrate the ability to utilize the two major technical reference materials, the U.S. D.O.T. Emergency Response Guidebook and the NFPA Guide to Hazardous Materials.

2. Safety Considerations

   2.1 Identify the hazards to health and safety created by hazardous materials emergencies.

   2.2 Describe protective equipment; its limitations and uses.

   2.3 Describe decontamination procedures.

3. Capabilities and Limitations of First Responders (Fire, Law, Medical, Other)

   3.1 Explain the roles of police, fire, pre-hospital and hospital personnel at the scene of a hazardous materials emergency.

3.2 Explain the risk assessment considerations to be made by first responders at a hazardous materials incident, with special attention to the limitations of first responders due to lack of specialized protective clothing, equipment and training.

3.3 Explain the implementation of a command system to assure coordination as the incident escalates.

3.4 Explain the rescue considerations of first responders at a hazardous materials incident.

3.5 Explain the evacuation considerations of first responders at a hazardous materials incident.

3.6 Explain the isolation and containment considerations of first responders at a hazardous materials incident.

3.7 Explain the environmental considertions to be made at a hazardous materials incident.

3.8 Describe local hazardous materials procedures.

4. Hazardous Materials: Pre-Emergency Planning and Resources

4.1 Describe federal, state and local government resources available for hazardous materials emergencies in Arizona.

4.2 Describe private agencies and facilities available for hazardous materials emergencies in Arizona.

4.3 Explain the importance of pre-emergency planning for hazardous materials incidents.

4.4 Explain the importance of coordination between the multiple agencies involved in hazardous materials response.

4.5 Describe the correct procedures for accessing additional resources.

(slide)

ESSENTIAL ATTITUDES

I. Hazardous Materials Incidents are not like routine calls!

II. Every responder must be realistic about capabilities and limitations!

III. The primary responsibility of every first responder is to promote safety for all!

IV. Coordinate and cooperate with all agencies responding to hazardous materials incidents.

(slide)

D.O.T. DEFINITION

"any substance or material in a quantity or form which poses an unreasonable risk to health, safety and property when transported in commerce"

(slide)

"any substance that jumps out at you when something goes wrong and hurts or harms the things it touches"

Ludwig Benner
(former Chief Hazardous Materials
Investigator for National
Transportation Safety Board)

(slide)

HAZARDOUS WASTE DEFINITION

Hazardous waste means any waste or combination of wastes which pose a substantial present or potential hazard to human health or living organisms because such wastes are nondegradable or persistent in nature or because they can be biologically magnified or because they can be lethal or because they may otherwise cause or tend to cause detrimental cumulative effects.

Code of Federal Regulations
Title 40. Part 261
Environmental Protection Agency

(Handout)

AGENDA

8:00- 9:00 AM -	Introduction	(30 minutes)
	Pretest	(20 minutes)
	Break	(10 minutes)
9:00- 9:20 AM	Overview	(5 minutes)
	Objectives	(5 minutes)
	Definitions	(15 minutes)
9:20-10:00 AM	Detecting the Presence of Hazardous Materials	(30 minutes)
	Break	(10 minutes)
10:00-11:00 AM	Reference Materials	(60 minutes)
	Break	(10 minutes)
11:00-11:50 AM	Personnel Protection and Safety	(40 minutes)
11:50- 1:00 PM	Lunch	
1:00- 2:00 PM	Characteristics of Hazardous Materials (Explosives, Compressed Gases)	(50 minutes)
	Break	(10 minutes)
2:00- 3:00 PM	Characteristics of Hazardous Materials (Flammable Liquids, Flammable Solids, Oxidizers, Organic Peroxides and Poisons)	(55 minutes)
	Break	(5 minutes)
3:00- 4:00 PM	Characteristics of Hazardous Materials (Corrosives, Radioactives, other Regulated Materials)	(30 minutes)
	Summary	
	Planning/Scene Management	(30 minutes)
4:00- 5:00 PM	Break	(5 minutes)
	Videotape/Summary	(30 minutes)
	Post Test	(20 minutes)
	Evaluation	(5 minutes)

SECTION OF STUDENT OUTLINE RELATING TO SECTION I

I. INTRODUCTION

The role of the first responder or anyone "first at the scene" of a hazardous materials incident is to protect life and property. The first responder accomplishes this crucial task by:

1. Establish command/control (scene management)
2. Detect the presence of hazardous materials.
3. Begin identification.
4. Evacuation.
5. Decontamination/personnel protection
6. Isolate incident/identity zones of activity.
7. Contain incident if possible from an isolated position with risk of exposure.
8. Seek additional appropriate resources.

Essential attitudes for first responders are:

1. Hazardous materials incidents are not like routine calls.
2. Even responder must be realistic about capabilities and limitations.
3. The primary responsibility of every first responder is to promote safety for all.
4. Coordinate and cooperate with all agencies responding to hazardous materials incidents

Define the term "hazardous materials."

D.O.T. -

"any substance or material in a quantity or form which poses an reasonable risk to health, safety and property when transported in commerce"

Benner -

"any substance that jumps out at you when something goes wrong and hurts or harms the thing it touches"

TEST QUESTIONS RELATING TO SECTION I

According to the Department of Transportation, the definition of hazardous materials is:

a. a substance or materials which has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated.

b. any materials or substance which, if improperly handled, can be damaging to the health and well-being of man.

c. any chemical which is a physical or health hazard.

d. a substance or material which when released into the atmosphere can create a hazard to firefighters, or citizens, as determined by the Department.

The first actions of a person who is first at the scene of a chemical accident should be:

a. rescue the injured immediately

b. dike and contain the chemical

c. take control of the accident scene, attempt to identify the chemical(s) involved and evacuate the area.

d. apply large amounts of water to the chemical(s)

II. DETECTING THE PRESENCE OF HAZARDOUS MATERIALS

A. Introduction (5 min.)

B. Lecture with slides (25 min.)

BREAK (10 min.)

STUDENT OBJECTIVES - MINIMUM CONPETENCIES/SKILLS

1.2 Describe the D.O.T. and N.F.P.A. identification and numbering systems for hazardous materials.

1.4 Describe the clues for detecting the presence of hazardous materials.

1.5 Recognize and identify the basic hazardous materials containers.

II. DETECTING THE PRESENCE OF HAZARDOUS MATERIALS

A. Explain Benner's DECIDE mnemonic briefly. (slide #1)

B. Lecture with slides (25 min.) *
This slide presentation will explain seven clues which can be used during planning or in actual responses to detect the presence of hazardous materials.

C. 10 minute break

* Option: use the slide/tape presentation "Recognizing Hazardous Materials" from the National Fire Academy's course Recognizing and Identifying Hazardous Materials (25 minutes)

A. Explain Benner's DECIDE mnemonic briefly (slide #1):

Benner's DECIDE mnemonic:

D - detect presence of hazardous materials

E - estimate likely harm

C - choose response objective

I - identify action options

D - do best option

E - evaluate progress

B. Clues for Detecting

Various clues may be present to help you detect the presence of hazardous materials. (slide #2)

These clues fit into seven groups: (slide #3)

- Occupancy/location;
- Container shapes;
- Markings and colors;
- Placards and labels;
- Shipping papers;
- Detection devices; and
- Your senses.

This list of clues is prioritized on the basis of least risk. Remember, the closer you get before you detect the hazardous material, the more chance you have of becoming "part of the problem."

If you can smell it - you are too close!

Let's discuss these groups of clues individually. (slide #4)

First. Occupancy/location. (slide #5)

Through pre-emergency planning and inspection activities, you should learn where hazardous materials are located in the community.

Learn where they are produced, transported, and stored throughout the community. For example:

Farmers use herbicides, pesticides and fertilizers on their fields.

Local health departments often use poisons and flammable materials.

High school chemistry labs use a wide range of hazardous materials. (slide #6)

Construction sites may use blasting agents or explosives, fuels, and gases.

Remember, inspection and planning allows you to become familiar with the hazardous materials in your community, where they are located, how they are used, and what precautions you should take. (slide #7)

Next, container shapes. (slide #8)

The Department of Transportation regulates the packaging used to transport hazardous materials. Other nationally recognized codes include specifications for bulk storage containers. (slide #9)

You should become familiar with the characteristics of the various containers then relate these characteristics to the contents during your pre-emergency planning and inspection activities.

Stationary storage tanks come in a variety of sizes and shapes.

Rail tank cars can be pressurized or non-pressurized.

For pressure cars, the fittings on the manway are totally enclosed. On non-pressure cars, the fittings are generally visible. (slide #10)

"Cryogenic" cars have no fittings on top. Loading and unloading is done from the sides.

Generally, pressure cargo tanks have visible rounded ends. Non-pressure cargo tanks have flat or nearly flat ends. (slide #11)

Ton containers are so named because they hold one ton of chlorine. Ton containers may hold other products like sulfur dioxide and phosgene. These ton containers are found at many water purification and sewage treatment plants. (slide #12)

Cylinders are found in many industrial situations, homes, and large swimming pools. (slide #13)

Drums are a common sight throughout the community. (slide #14)

Even fiberboard boxes can contain hazardous materials. (slide #15)

Markings and colors can also indicate the presence of hazardous materials. (slide #16)

The name of hazardous materials will be found in 4-inch letters on both sides of rail tank cars. They will be on your right as you face the car. (slide #17)

Identification numbers are designed to identify hazardous materials in transportation.

Identification numbers must be displayed on cargo tanks, portable tanks, rail tank cars, and certain small packages carrying hazardous materials.

Identification numbers will be displayed either:

In 4-inch high numerals on a 6 x 16 inch, orange panel found near the placards, or (slide #18)

In 3-1/2 inch high numerals in the center of the placard, or

In 3-1/2 inch high numerals on a white square-on-point background. This plain marking is used for environmentally hazardous materials not requiring a placard.

The identification number is not displayed on a poison gas, radioactive, or explosive placard. If required, it will be found on the orange panel.

Don't confuse identification numbers with state and local trailer registration numbers.

On small packages of hazardous materials, the identification number should be found next to the proper shipping name.

The National Fire Protection Association has developed a marking system for identifying hazardous materials at terminals and industrial sites. However, this system is not used in transportation. (slide #19)

The NFPA marking is diamond shaped and broken into four quadrants. The blue quadrant on the left refers to health, the red at the top - flammability, and the yellow on the right - reactivity. The white quadrant at the bottom carries special information, such as the propeller for radioactive materials. O-X-Y - for oxydizers, and a "W" with a slash for water reactive materials.

Each of the colored quadrants bears a number quadrants bears a number from 0 through 4. A zero indicates minimum hazard, while a four indicates maximum hazard.

For example, look at this situation.

The NFPA marking is two/three/two indicating significant hazards in health, flammability and reactivity. (slide #20)

Company names or logos may provide clues to the presence of hazardous materials. (slide #21)

Placards and labels are familiar signs of hazardous materials presence. (slide #22)

Placards and labels are designed to alert you to the presence of hazardous materials in transportation. The placard or label applied is determined by the hazard class of contents.

Placards and labels convey information by their color symbol. United Nations Hazard Class number, and either the Hazard Class wording or four-digit identification number. (slide #23)

The 4 x 4 inch label is found on small packages; that is, packages up to 640 cubic feet in size. The label should be found close to the commodity name and the identification number. (slide #24)

Multiple labels indicate more than one hazard. In case of acrylonitrile, for example, two labels -- flammable liquid and poison -- are found on the drum. (slide #25)

Labels are not found on bulk packages like cargo tanks and tank cars -- a placard is used. (slide #26)

When small packages or bulk products are loaded into highway or rail vehicles.

A 10-3/4 x 10-3/4 inch diamond shaped placard is applied to both ends and both sides of the vehicle.

However, no placards are required for trailers or containers if they carry less than 1,000 pounds of most classes of hazardous materials.

Also, no placards are required for ORMs or limited quantity shipments. (slide #27)

Be careful when you see the "dangerous" placard. It could mean multiple classes of hazardous materials in the same vehicle, or it could mean a shipment of "Class C Explosives" or "Irritants." (slide #28)

So, check the shipping papers to be sure.

Vehicles carrying multiple commodities must display a placard for each hazard class in a quantity of more than 5,000 pounds. This is in addition to any other required placarding.

Placards with square white backgrounds indicate rail shipments of poison gas or explosives requiring special handling or highway shipments of large quantities of radioactive materials requiring special routing.

"Empty" placards are applied to rail tank cars to indicate that a hazardous residue remains after unloading. Note the black triangle with the word "empty" in white. Cargo tanks display the loaded placard, whether loaded or empty. (slide #29)

Shipping Papers are an excellent source for detecting the presence of hazardous materials during transportation. (slide #30)

Shipping papers, which must accompany a hazardous material shipment describe the shipment in a specific way. You should become familiar with the types of shipping papers used in the various modes of transportation through your community. (slide #31)

All hazardous material shipping papers must contain the following entries: (slide #32)

- o The proper shipping name;
- o The hazard class.

If the lading is a hazardous waste, the word "waste" will precede the proper shipping name.

If the lading is classed as a poison and that fact is not obvious by the proper shipping name, the word poison and the technical name of the poison will be shown in association with the shipping description.

Now, let's look at shipping papers used in the different modes of transportation. (slide #33)

In rail transportation, two types of shipping papers are generally found -- the waybill and the consist or wheel report.

The shipping description previously mentioned indicates the presence of a hazardous material.

Rail shipping papers are the responsibility of, and are kept by, the conductor who usually rides in the caboose. Some railroads also provide copies of the consist or wheel reports to the engine crew. (slide #34)

In case of the release of a hazardous material, the train crew members have been instructed to share the shipping paper information with the first arriving emergency response agency.

You should check with the train crew member to pinpoint the first and last cars detailed, thus indicating the cars involved, then check the shipping papers to see if any of the cars involved contain hazardous materials.

In highway transportation, the shipping paper is called (slide #35)

the "Bill of Lading." The driver of the vehicle is responsible for the bill of lading.

Bills of lading are kept in the cab of the vehicle, either in a pouch on the door, or on the driver's seat. (slide #36)

Each hazardous material shipment should be described on the bill of ladingusing the shipping description previously discussed.

For some bulk and truckload shipments, a manufacturer's data sheet is attached to the bill of lading to identify hazards, characteristics, and response procedures for the material.

If the bill of lading is unavailable, contact the dispatcher of the trucking company. To obtain the shipping description information, you must provide the truck or trailer number.

For air transportation, the shipping paper is called an "Air Bill." (slide #37)

Air bills are the responsibility of the pilot and are kept in the cockpit.

Monitoring and Detection Devices (slide #38)

Instruments and meters can detect the presence of hazardous materials in the atmosphere and measure the concentrations. (slide #39)

However, such devices can be expensive and are not often available to first responders.

In addition, use of these instruments may put you in harm's way as you risk exposure to the material.

Senses

Your own senses -- smell, sound, touch, or sight -- can also help you detect the presence of hazardous material. (slide #40)

Odors may indicate the presence of hazardous materials. Remember, if you can smell a hazardous material, it is time to get out. Odors, like those of rotten fruit or eggs, freshly cut grass, decaying fish, etc., are characteristic of certain hazardous materials.

Some chemicals can rapidly deaden your sense of smell. You may not be able to smell the chemical on your second or third sniff. But it's still there. (slide #41)

The presence of a vapor cloud, dead animals (slide #42)

or fish, or a fire, are strong indications of the possible presence of hazardous materials. (slide #43)

The color of smoke and flame can help identify a hazardous material. (slide #44)

Irritation to the eyes or skin is also a signal that you are being exposed and that you should leave the danger area. (slide #45)

To review, seven categories of clues are used to detect hazardous materials: (slide #46)

Occupancy and location;
Container shapes;
Markings and colors;
Placards and labels;
Shipping papers;
Detection Devices, and
Senses

SECTIONS OF STUDENT OUTLINE RELATING TO SECTION II.

II. DETECTING THE PRESENCE OF HAZARDOUS MATERIALS

A process for decision-making at hazardous materials calls has been described by Ludwig Benner with the mnemonic D.E.C.I.D.E. This stands for:

D - detect the presence of hazardous materials

E - estimate likely harm

C - choose response objectives

I - identify action options

D - do best option

E - evaluate progress

Clues for detecting the presence of hazardous materials.

1. occupancy/location
2. container shapes
3. markings/colors
4. placards/labels
5. shipping papers
6. detection devices
7. senses

TEST QUESTIONS RELATING TO SECTION II

Four clues available to first responders for detecting the presence of hazardous materials are:

1. i.d. numbers, leaking containers, fire, color of smoke
2. pre-emergency planning, container shapes, name sounds hazardous, senses
3. placards and labels, pre-emergency planning, container shapes, detection devices
4. boxes, design features, color of spilled material, i.d. numbers.

A diamond-shaped, 4 x 4 inch, identification tool for emergency responders found on one side of a container under 640 cubic feet, holding hazardous materials is called a:

1. label
b. placard
c. U.N. Number
d. C.F.R. Code

A diamond, shaped 10-3/4 inches square, identification tool for emergency responders found on the exterior of vehicles transporting hazardous materials is called a:

a. label
b. placard
c. U.N. Number
d. C.F.R. Code

DOT placards provide information in which of the following ways:

a. colors
b. numbers
c. words
d. "a" and "b" only
e. all of the above

III. REFERENCE MATERIALS - IDENTIFYING HAZARDOUS MATERIALS

A. Lecture on NFPA Guide on Hazardous Materials (20 min.) (with book)

B. Lecture on DOT Emergency Response Guidebook (20 min.) (with book)

C. Material Safety Data Sheets (5 min.)

D. Activity (15 min.)

Break (10 min.)

STUDENT OBJECTIVES - MINIMUM COMPETENCIES/SKILLS

1.7 Identify technical reference materials for hazardous materials emergencies.

1.8 Demonstrate the ability to utilize the 2 major technical reference materials, the U.S.D.O.T. Emergency Response Guidebook and the NFPA Guide to Hazardous Materials.

2.2. Describe protective equipment; it's limitations and uses.

III. REFERENCE MATERIALS

A. Lecture with books (20 minutes)

NFPA Fire Protection Guide on Hazardous Materials

Divided into 4 sections (have students turn to each section as you explain)

1. Fire hazard properties of flammable liquids, gases, volatile solids
2. Hazardous chemical data
3. Manual of hazardous chemical reactions
4. Standard system for identification of the fire hazard of materials (fire diamond.) (704M)

Section 704M (Fire Diamond) applies to industrial and institutional fixed facilities, not to transportation of products. Use of the fire diamond is required only where adopted by local jurisdictions

The Fire Diamond provides a simple system of readily recognizable and easily understood markings which provide general information regarding the hazards of any material and the order of the severity of hazards as they relate to fire prevention exposure and control.

a. Health Section - Blue
   1) Marked numerically to indicate order of severity
      a) 4 - under normal conditions or fire conditions are extremely hazardous (i.e., toxic or corrosive) through inhalation, contact or absorption
      "special clothing only"
      b) 3 - serious temporary or residual injury on short exposure
      "special clothing only"
      c) 2 - continued exposure could cause injury
      "full clothing"
      d) 1 - irritation or minor injury
      "full clothing"
      e) 0 - ordinary hazard
      "full clothing"

(Note that even a "3" in health calls for "no skin surface exposed")

b. Flammability Section - Red
   1) Susceptibility of materials to burn
      a) 4 - very flammable gases or very volatile flammable liquids. Fire fighting stages include shutting off flow and cooling tanks or containers
      b) 3 - can be ignited under almost all normal temperature conditions. Low flash point may make ineffective.
      c) 2 - must be moderately heated before ignition will occur. Water will cool.
      d) 1 - must be preheated before ignition will occur. Water will cool.
      e) 0 - will not burn

(4 or 3 indicates special extinguishing agents needed to put fire out.)

c. Reactivity Hazards Section - Yellow
   1) Susceptibility of materials to release of energy and to what extent. Should indicate to responders whether to evacuate area. Use caution, or just use normal procedures.
   2) Water may cause reaction
   3) Numerically rated
      a) 4 - readily capable of detonation or explosive reaction at normal temperatures and pressures. Sensitive to shock. Evacuate area if advanced stages of fire.
      b) 3 - requires initiation source or heat to explode.
         will react violently with water
      c) 2 - will chemically change but not detonate. May react violently with water.
      d) 1 - normally stable but becomes unstable with heating
      e) 0 - normally stable even under fire conditions

d. Miscellaneous Section - white
   1) to denote special hazards encountered with material
   2) "W", possible hazard of using water, reactive with water
   3) "P", self-reacting or polymerize
   4) " ", radioactivity
   5) "OXY", oxidizing agents, yields oxygen readily to simulate or support combustion to the point that they will burn with savage intensity. Organic peroxides will probably explode if involved in a fire.

e. See Section 49 for definition of "full protective clothing" and "special clothing". Relate the information regarding protective clothing to non-fire personnel in class. Be sure they understand how ill-equipped they are in street clothes. Emphasize that this information is not just for the firefighters.

f. Activity: Ask students to use NFPA Guide on Hazardous Materials to learn about liquid nitrogen. Ask individuals to give the information found.

B. Lecture with book - D.O.T. (20 min.)

U.S. D.O.T. Emergency Response Guidebook

The Emergency Response Guidebook is published by the U.S. Department of Transportation It is designed to assist emergency personnel during the initial phases of a hazardous materials incident.

1. The first page of the guide provides special instructions for using the book. Read this page carefully. It will explain how to use the book.

2. Page v lists the United Nations Classification System for hazardous materials. The UN Hazard Class number may be displayed at the bottom of a placard or label.

   Class 1 - Explosives
   Class 2 - Gases
   Class 3 - Flammable Liquids
   Class 4 - Flammable Solids

Class 5 - Oxidizers, Organic Peroxides
Class 6 - Poisonous
Class 7 - Radioactive
Class 8 - Corrosives
Class 9 - Miscellaneous

3. Page vi provides a definition of full protective clothing and special protective clothing.

4. D.O.T. placards are diamond shaped - 10 3/4" square. Placards provide information four ways:

   a. color
   b. number
   a. symbols
   c. words

5. Labels are diamond shaped 4 x 4". Labels are used on hazardous materials containers under 540 cubic feet.

6. Yellow pages:
   a. Use when you have the I.D. numbers.

7. Blue/gray pages:
   a. Use when you know the correct spelling of the product but not the I.D. number.

8. "Guide"pages:
   a. listed in yellow and blue/gray pages for each product
   b. provide response information

9. "Guide" information:
   a. fire or explosion hazard
   b. health hazards
   c. "emergency action" to take
   d. "fire" information
   e. "spill or leak" information
   f. "basic first aid" information

10. Limitation of "guides".
    a. many different chemicals under one guide - only 56 guides
    b. basic reference
    c. identifies most significant potential hazards

11. Special "Guides" when materials cannot be identified by name or I.D. number:
    a. Guide 11 - "catch all"
    b. Guide 46 - Class A,B explosives
    c. Guide 50 - Class C explosives
    d. Guides for placards - back of book

12. Isolation and Evacuation Distances
    a. at back of book
    b. for materials appearing in bold print on yellow or blue pages

13. Limitation of placards
    a. A recent study by the federal Office of Technology Assessment reported that 25 to 50% of the placards on shipments of hazardous materials are incorrect.

C. Material Safety Data Sheets (5 min.)

Another important source of information for first responders are the "Material Safety Data Sheets".

OSHA requires that all manufacturers of hazardous materials must provide all buyers of the materials with MSDS and labels for each product. (OSHA - Hazard Communication Standard, 29 CFR 1910.1200) In turn the users of the chemicals must provide their employees with access to the MSDS and training on how to read the sheets and labels. Employers must have a Material Safety Data Sheet for each hazardous chemical they use.

These data sheets must include information on the following:

1. chemical and common name
2. if mixture, the chemical and common name of ingredients.
3. physical and chemical hazards
4. physical and chemical properties
5. health hazards
6. primary route of entry
7. OSHA permissible exposure level. TLV and/or other exposure limits
8. if known carcinogen
9. handling/safety precautions
10. known applicable control measures
11. emergency and first aid procedures
12. name, address, telephone number of chemical manufacturer, importer or other responsible party

D. Student Activity (15 min.)

1. Have students form groups of 5-6. Hand out activity sheets.
2. Instruct students to solve problems on activity sheet as a group, using the NFPA Fire Protection Guide on Hazardous Materials and the U.S. D.O.T. Emergency Response Guidebook.

3. Ask students to work as quickly as possible. Reserve time at the end of this section to discuss the problems.

STUDENT ACTIVITY

Using the reference materials provided for each hazardous material listed find the I.D. number and the major characteristics of concern to responders.

	I.D. NUMBER	CHARACTERISTICS
1. Ammonium Nitrate	_____	_____
	_____	_____
	_____	_____
2. Chlorine	_____	_____
	_____	_____
	_____	_____
3. Methyl Ethyl Ketone	_____	_____
	_____	_____
	_____	_____

Using the reference materials provided, solve the following problem:

1. Assign an NFPA 704 marker for the entrance of a building normally storing acetylene and trinitrotoluene.

TOXICITY RATING	_____	(BLUE)
FLAMMABILITY RATING	_____	(RED)
REACTIVITY RATING	_____	(YELLOW)
SPECIAL INFORMATION	_____	(WHITE)

III. REFERENCE MATERIALS - IDENTIFYING HAZARDOUS MATERIALS

There are two primary identification systems used in the U.S. for hazardous materials - the NFPA system for marking buildings and the Department of Transportation (D.O.T.) system for marking vehicles and containers and packages.

The NFPA has a Fire Diamond divided into four sections. Each section is a different color and indicates a specific type of hazard. The four sections and color associated with each are:

1. Blue - Health
2. Red - Flammability
3. Yellow - Reactivity
4. White - Special Information

Each color section is marked numerically to indicate order of severity of hazard:

Health Section - Blue

a) 4 - under normal conditions or fire conditions are extremely hazadardous (i.e., toxic or corrosive) through inhalation, contact or absorption
b) 3 - serious temporary or residual injury on short exposure "special clothing only"
c) 2 - continued exposure could cause injury "full clothing"
d) 1 - irritation or minor injury "full clothing"
e) 0 - ordinary hazard "full clothing"

Flammability Section - Red

a) 4 - very flammable gases or very volatile flammable liquids. Fire fighting stages include shutting off flow and cooling tanks or containers.
b) 3 - can be ignited under almost all normal temperature conditions. Low flash point may make ineffective.
c) 2 - must be moderately heated before ignition will occur. Water will cool.
d) 1 - must be preheated before ignition will occur. Water will cool.
e) 0 - will not burn.

Reactivity Hazards Section - Yellow

a) 4 - readily capable of detonation or explosive reaction at normal temperatures and pressures. Sensitive to shock. Evacuate area if advanced stages of fire.
b) 3 - requires initiation source or heat to explode.
c) 2 - will chemically change but not detonate. May react violently with water.
d) 1 - normally stable but becomes unstable with heating
e) 0 - normally stable even under fire conditions

Miscellaneous Section - White

1) to denote special hazards encountered with material
2) "W", possible hazard of using water reactive with water
3) "P ", self-reacting or polymerize
4) " ", radioactivity

5) 'OXY", oxidizing agents, yields oxygen readily to simulate or support combusion to the point that they will burn with savage intensity. Organic peroxides will probably explode if involved in a fire.

The NFPA defines full protective clothing as:

> includes helmet, S.C.B.A., coat and pants customarily worn by fire-fighters (turn-out or bunker coat and pants), rubber boots, gloves, bands around legs, arms and waist, and face mask, as well as covering for neck, ears and other parts of the head not protected by the helmet, S.C.B.A. or face mask.

The NFPA defines special clothing as:

> clothing specially designed to protect against a specific hazard and recommended for those chemicals with a health hazard rating of 4.

D.O.T. placards are diamond shaped - 10-3/4" square. They provide information on hazardous materials in several ways.

1. color
2. numbers
3. symbols
4. words

List the categories of hazardous materials under the United Nations Classification System:

1. explosives
2. gases
3. flammable liquids
4. flammable solids
5. oxidizers and organic peroxides
6. poisons
7. radioactives
8. corrosives
9. miscellaneous

When using the 1984 D.O.T. Emergency Response Guidebook, if you fail to identify the material involved by either name or ID number, you should use Guide 11.

TEST QUESTIONS RELATING TO SECTION III

The 1984 D.O.T. Emergency Response Guidebook provides information relating to:

a. flash point and flammability range

b. fire or explosion hazard, health hazards, spill or leak information

c. detailed, commodity specific recommendations

d. the roles of federal response agencies

When using the 1984 D.O.T. Emergency Response Guidebook, if you fail to identify the material involved by finding either its name or I.D. number, you should:

a. use Guide 11 until additional information or help becomes available to you.

b. use Guide 75 until additional information or help becomes available to you.

c. no guides are available for your use.

d. all guides are the same, so just use any available.

The white section of the N.F.P.A. Fire Diamond provides information on:

a. health

b. reactivity

c. special hazards

d. flammability

Full Protective Clothing, as used by N.F.P.A. 49 - Hazardous Chemical Data, is defined as:

a. protection to prevent all gases, vapors, liquids and solids from coming in contact with the skin under any condition.

b. includes helmet, S.C.B.A., coat and pants customarily worn by fire-fighters (turn-out or bunker coat and pants), rubber boots, gloves, bands around legs, arms and waist, and face mask, as well as covering for neck, ears and other parts of the head not protected by the helmet, S.C.B.A. or face mask.

c. clothing specially designed to protect against a specific hazard and recommended for those chemicals with a health hazard rating of 4.

d. none of the above

Special Protective Clothing, as used by N.F.P.A. 49 - Hazardous Chemical Data, is defined as:

a. protection to prevent gases, vapors, liquids, and solids from coming in contact with the skin.

b. includes helmet, S.C.B.A., coat and pants customarily worn by fire-fighters (turn-out or bunker coat and pants), rubber boots, gloves, bands around legs, arms and waist, and face mask, as well as covering for neck, ears and other parts of the head not protected by the helmet, S.C.B.A. or face mask.

c. clothing specially designed to protect against a specific hazard and recommended for those chemicals with a health hazard rating of 4.

d. none of above

The N.F.P.A. 704, Standard System for the Identification of the Fire Hazards of Materials, identifies the hazards of the material in terms of three principal categories, namely:

a. reactivity, health and flammability

b. instability, reactivity and health

c. flammability, health and energy

d. flashpoint, instability and energy

When using the 1984 D.O.T. Emergency Response Guidebook, the first actions to take are to approach incident from upwind, if possible, staying clear of all spills, vapors, fumes, and smoke, and:

a. identify the materials by finding the 4-digit I.D. number on a placard or orange panel.

b. identify the materials by finding the 4-digit I.D. number on a shipping paper.

c. identify the material name on a shipping paper, placard, label or package.

d. all of the above

The N.F.P.A. 704, Standard System for the Identification of the Fire Hazards of Materials, indicates the order of severity numerically by five divisions ranging from:

a. five to zero, with five indicating no special hazard.

b. four to zero, with four indicating no special hazard.

c. five to zero, with five indicating a severe hazard.

d. four to zero, with zero indicating no special hazard.

IV. PERSONNEL PROTECTION AND SAFETY

A.	Lecture/discussion with slides	(20 minutes)
B.	Slide/tape presentation, videotape or group activity	(25 minutes)
C.	Summary	

STUDENT OBJECTIVES - MINIMUM COMPETENCIES/SKILLS

2.1 Identify the hazards to health and safety created by hazardous materials emergencies.

2.2 Describe protective equipment; its limitations and uses.

2.3. Describe decontamination procedures.

A. Lecture with Slides (20 minutes)

So far we have addressed the first major objective for first responders: recognition and identification. Now we will consider the second major objective: safety (slide IV-1)

Hazardous materials invade your body by: (slide IV-2)

inhalation
skin absorption
ingestion
injection

The main mechanisms of harm can be recalled with one mnemonic TRACEM: (slide IV-3)

Thermal
Radiation
Asphyxiation
Chemical
Etiological
Mechanical

Hazardous materials can hurt you. We can see this in the following slides: (slides IV-4, 5, 6 and 7)

At hazardous materials incidents, you must provide protection for all persons at or near the scene - including your own personnel. Remember hazardous materials incidents are not routine calls. Special care must be taken to avoid serious injury or death. (slide IV-8)

Hazards of chemicals may be apparent or they may be insidious. You may not be able to see it, feel it or smell it. Never enter the scene of a hazardous materials incident without first assessing the risk present. If you do not have the appropriate monitoring or detection devices to determine the level of risk, wait for the arrival of those who do. Isolate the incident; isolate the danger zone - the hot zone - and limit access to that area. (slides IV-9)

If responders, victims or bystanders are exposed to the hazardous material, rescue and decontamination must be addressed. (slide IV-10)

These elements are critical to the successful management of any hazardous materials incident:

A primary consideration in victim rescue must be rescuer protection. (slide IV-11)

Rescue personnel must understand the dangers to the victim and rescuer alike.

A primary consideration in rescuer protection must be the availability of protective clothing and self-contained breathing apparatus. (slide IV-12)

In some cases, rescue may not be possible without the assistance of trained personnel in special (Level A) protective clothing (fully encapsulating). (slide IV-13)

Non-fire personnel must realize how vulnerable they are without respiratory protection and protective clothing. (slide IV-14)

Law enforcement officers and others must resist the temptation to rush into harm's way when rescue is called for.

In the removal of victims from the immediate area, consideration should be given to whether or not the victim has been contaminated with any hazardous materials. (slide IV-15)

If the victim has been contaminated, he should initially be taken to a decontamination area. The decontamination area may be adjacent to the primary triage and treatment area, but care must be taken to avoid recontamination of victims and the emergency personnel assigned to the triage and treatment sector. (slide IV-16)

All personnel working in the decontamination section should wear:

Protective clothing including gloves, and any additional protective equipment as required by the product. (slide IV-17)

The most important element in decontamination is undressing the victim completely to avoid continued absorption of toxic materials from soaked clothing. The second most important element is a thorough skin flush with large amounts of water. (slide IV-18)

If possible, the decontamination area should be set up where the used irrigation water may be contained for proper disposal. (slide IV-19)

The decontamination process is completed by appropriate containment of the used water for recovery and proper disposal during final clean-up operations.

The decontamination area, with decontamination personnel still in protective gear, should be maintained until all personnel (victims, bystanders, buffs and rescue personnel) have been declared free of ill effects from the toxic substances involved in the incident. (slide IV-20)

All rescue personnel should be evaluated on the scene or in a medical facility, prior to returning to other activities. If contamination of protective gear or other clothing has occurred, it must be decontaminated before being taken to the workplace or home due to the possibility of contaminating others. (slide IV-21)

Decontamination is important especially if the victim is to be transported in an enclosed rescue vehicle. (slide IV-22)

Contamination of transport personnel and of transport vehicles must be avoided.

When multiple victims are involved, patient transport may also involve impromptu use of public safety and even private vehicles. (slide IV-23)

Care must be taken to avoid contamination of the vehicles and of the personnel operating these vehicles.

In summary, before anyone attempts rescue at a hazardous materials incident, they must consider: (slide IV-24)

- rescuer protection
- victim protection
- decontamination

The importance of personnel protection cannot be overemphasized. First responders must understand that without accurate identification of the product, without assessment of the risk, without proper protective clothing and equipment - and without proper training - site entry or intervention may lead to serious injury or death. Do not become part of the problem. (slide IV-25)

B. Audiovisuals or Activity (25 minutes)

1. Option A - fire orientation

   INTRODUCE slide/tape program.
   "NFPA Protective Clothing for Hazardous Materials Incidents"

   Note: where possible, bring examples of protective gear to class. If time allows, students might be able to try on suits, etc.

2. Option B - fire orientation

   INTRODUCE "safety" videotape

3. Option C - mixed audience

   Group Activity

   Case Study: Have students divide into groups of 5 or 6. Ask them to read the scenario and explain the actions they would take if they were first on the scene. What rescue considerations would they make?

C. Summary

Briefly, refer students to handout of objectives. Point out the three objectives addressed in this section.

Option 3 Case Study (25 minutes)

It is 0420 hours. You pass milepost 248 on I-40 Westbound and you discover a truck over on its side. The vehicle is placarded "Corrosive" with an ID number of 1809.

The driver and co-driver are still in the vehicle, which is lying on its right side across the entire width of the roadway. There is no movement visible in the cab of the truck.

There is a liquid leaking from the front of the trailer. The temperature is 50; the wind is 2-3 mph from the northwest.

What is your initial action?

What are your rescue considerations?

Section of Student Outline Relating to Section IV

IV. PERSONNEL PROTECTION AND SAFETY

The main mechanisms of harm can be recalled with the mnemonic TRACEM which stands for:

T - Thermal

R - Radiation

A - Asphyxiation

C - Chemical

E - Etiological

M - Mechanical

Four ways by which hazardous materials can invade your body:

1. inhalation

2. skin aborption

3. ingestion

4. injection

Before emergency personnel should attempt rescue at a hazardous materials incident, they must consider:

1. rescuer protection

2. victim contamination

3. decontamination

Test Questions Relating to Section IV

TRACEM is a word used to remind you of how hazardous materials can hurt you. It stands for:

a. thermal, radiation, asphyxiation, chemical, etiological, mechanical
b. terrible radiation and chemical emergency
c. thermal, radiation, aspiration, caustic, etiological, mechanical
d. none of the above

The first person at an incident involving victims of a hazardous materials exposure should:

a. immediately rescue the injured and begin decontamination
b. rescue the injured and notify the nearest poison center
c. assess the risk, consider rescuer and victim protection
d. none of the above

V. CHARACTERISTICS OF HAZARDOUS MATERIALS
(Explosives, Compressed Gases)

A. Lecture/slides on explosives (10 min.)

B. Activity (5 min.)

C. Lecture/slides on cases (20 min.)

D. Film on BLEVE (25 min.)

E. Break (10 min.)

STUDENT OBJECTIVES - MINIMUM COMPETENCIES/SKILLS

1.3 Describe the chemical and physical properties of explosives and gases.

1.5 Recognize and identify the basic hazardous materials containers for explosives and gases.

1.6 Evaluate the behavior of compressed gas containers under types of stress, breach, release and impingement.

2.1 Identify the hazards to health and safety created by hazardous materials emergencies involving explosives and compressed gases.

3.2 Explain the risk assessment considerations to be made by first responders at a hazardous materials incident, with special attention to the limitations of first responders due to lack of specialized protective clothing, equipment and training.

3.4 Explain the rescue considerations of first responders at a hazardous materials incident involving explosives and compressed gases.

3.5 Explain the evacuation considerations of first responders at a hazardous materials incident involving explosives and compressed gases.

3.6 Explain the isolation and containment considerations of first responders.

3.7 Explain the environmental considerations to be made at a hazardous materials incident involving explosives and compressed gases.

CHARACTERISTICS OF HAZARDOUS MATERIALS
(Explosives, Compressed Gases)

A. Lecture with slides (10 min.)

1. Definition

Explosives are chemical compounds, mixtures or devices - the primary or common purpose of which is to function by blowing up. (slide V-1)

When subjected to heat, impact, contamination, friction or other suitable initial impulse, they undergo a rapid chemical transformation producing large quantities of heat and gases.

The simultaneous release of heat in the presence of gases causes the gases to expand so rapidly that they exert an exceedingly high pressure on the surrounding environment. This pressure causes shock waves to travel at velocities that can exceed the speed of sound. (slide V-2)

2. Principal Hazards

The principal hazards associated with explosives are: (slide V-3)

- blast-over pressure
- shock waves
- scattering fragments
- additional fires

3. Detection

Explosives are used in military and commercial operations. Commercial explosives are most readily available to the average person and therefore the most common. For example, these may be found at shooter supply stores and construction sites. (slide V-4)

The Department of Transportation classifies explosives into three classes: A, B, and C. The placards are orange in color. (slide V-5)

Class A explosives present the greatest hazard. These detonate rapidly when exposed to a spark. Examples of Class A explosives are: dynamite, TNT. (slide V-6)

Class B explosives function by rapid combustion (burning) rather than by detonation. Examples are propellant explosives, fireworks and rocket motors. (slide V-7)

Class C explosives present the least hazard. (They may contain small restricted quantities of class A or class B explosives. Examples include flares, fuse igniters and small arms ammunition. The principal hazard is fire. (V-8)

A special classification of explosives is blasting caps. There are two types: electric and non-electric. Both caps are extremely sensitive to heat, shock and friction. Blasting caps should never be stored with other explosives. (slide V-9)

Fiberboard boxes are generally used for packaging of these products. (slide V-10) Military explosives may be encountered in transportation or in instances where they have been stolen from military installations. (slide V-11)

4. Incident Objectives

If an accident involving these materials results in an explosion, about the only thing that can be done is to care for the injured and to prevent the spread of any fire which may have been caused by the explosion. (slide 12)

If explosives are involved in an accident and fire is not present, the first and foremost precaution is to prevent fire.

The area should be guarded to keep all unauthorized persons away.

The recommended evacuation distances for explosives are: (slide V-13)

Class A - 1 mile
Class B - 1/2 mile
Class C - 1500 feet

Protect yourself by distance, careful handling, appropriate protective clothing and respiratory protection. (slide V-14)

Never drop, throw, tumble or slide explosives or handle roughly.

Always use non-sparking tools.

Never transport in vehicles utilizing metal flooring or beds.

Beware of toxic fumes produced by the burning or detonation of explosives in enclosed areas. Respiratory protection may be appropriate.

5. Resources

If explosives are involved in a transportation accident, the shipper should be notified. If the railroad is involved, the Bureau of Explosives should be notified. (slide V-15)

Police bomb squads and military installations such as Luke Air Force Base can provide personnel with expertise in the handling of explosives.

Become acquainted with these persons before an incident occurs.

In summary, the orange placards designate explosives. (slide V-16)

The possible hazards of explosives are: (slide V-17)

a. blast-over pressure
b. shock waves
c. scattering fragments
d. additional fires

B. Activity (5 min.)

1. Ask students to use the D.O.T. Emergency Response Guide and the NFPA Guide on Hazardous Materials to research quickly:

   "trinitrobenzene"

2. Ask students to report their findings in terms of: hazards present, protective clothing, and course of action under fire conditions and with no fire.

C. Lecture with Slides - compressed gases (20 min.)

1. Definition

   Matter exists in three states: solids, liquids and gases. Solids have definite volume and shape. Liquids have volume and take on the shape of their containers. Gases have neither volume or shape. They must be contained on all sides. This category of hazardous materials is known as compressed gases. (slide V-18)

2. Hazards

   Compressed gases present multiple hazards when mishandled: (slide V-19)

   - BLEVE (Boiling Liquid Expanding Vapor Explosion)
   - Explosion
   - Asphyxiation
   - Toxicity/corrosiveness
   - Frost bite
   - Reactivity

   We will discuss these hazards as we look at compressed gases and we will see examples of the serious threats these gases can pose.

3. Detection

   As you examine your community, you will find compressed gases in a wide variety locations. (slide V-20)

   Welding shops, chemical processing plants, water treatment facilities, medical facilities.

   Multiple industrial commercial uses as well as residential uses.

   The Department of Transportation uses three categories to identify compressed gases: flammable, non-flammable and poison. (slide V-21)

   There are three distinct placards for each.

   Flammable gases will ignite easily on contact with an ignition source. Examples of flammable gases are: acetylene, butane and propane. (slide V-22)

   Acetylene is used in welding operations and in the production of synthetic chemicals and plastic.

   Butane and propane are common fuels and are found throughout most communities.

Non-flammable gases generally will not burn readily; however, if the concentraton in air is high enough, non-flammable gases will burn. (slide V-23)

As gas vapors mix with the air, an ignitable mixture is formed. When there is not enough fuel to mix with the air, the mixture is said to be "too lean" to burn.

Too much vapor in air can create a mixture "too rich" to burn. Between these two extremes is the "flammable range" for a product.

At the "lean" end is the Lower Explosive Limit. At the "too rich" end is the Upper Explosive Limit. (slide V-24)

A large enough concentration of a non-flammable gas in an enclosed space may create a mixture within the flammable range for that product.

Stop slides here

Use your reference materials and look up the product anhydrous ammonia.

Ask students to report their findings on anhydrous ammonia. Show slides of anhydrous ammonia explosion in Houston, Texas (Borden plant) - an explosion of a so called "non-flammable gas". (slide V-25)

Start slides again

The Borden incident illustrates the limitations of the D.O.T. identification system. Although products are classified by their most significant hazard, multiple hazards may exist. (slide V-26)

Chlorine is a non-flammable gas but is also highly poisonous, highly toxic and requires its own placard in transportation. (slide V-27)

Chlorine is commonly found in communities due to its role in water purification.

In addition to being classified as flammable, non-flammable and poisonous, gases may be described as liquified. (slide V-28)

A liquid gas is a refrigerated gas: a gas that has been converted to a liquid by reducing its temperature to subzero levels.

Cryogenic refers to a liquified gas whose temperature is below -150 degrees F. The term "cryogenic" is being replaced by "refrigerated liquid" to cover all liquified gases. (slide V-29)

When released from their containers, liquified gases or refrigerated gases are extremely hazardous. A brief contact with the liquid can cause severe frostbite. (slide V-30)

Examples of cryogenics are liquid ethylene and liquid hydrogen.

Compressed gases require specially constructed pressure vessels for storage or transport. Such containers are readly recognizable, enabling you to detect the presence of such gases.

4. Incident Considerations

Gases present multiple hazards to response personnel. We have seen an example of the danger of explosion. We mentioned the possibility of frostbite and refrigerated gases.

In closed spaces, gases can displace oxygen creating the danger of asphyxiation.

Some gases may be toxic or corrosive, such as sulfur dioxide and hydrogen chloride.

Protection for responders may take many forms depending on the specific product. Product identification and research is necessary to detemine the type and level of protection required.

Distance is always a sure method of protection.

As responders we must be particularly concerned with the behavior of pressurized liquid gas containers - cylinders or cargo tankers. Although the gases may have a number of inherent dangers due to their chemical characteristics, the primary danger lies with their containers. Steel cylinders of liquid gas under pressure may rupture violently when damaged in an accident or exposed to fire. If heated, the pressure in these containers will build rapidly, causing the cylinders to come apart. Gases and pieces of cylinders may travel great distances. All unauthorized personnel should be kept at a minimum distance of 1500 feet from the incident. This phenomenon is called BLEVE: Boiling Liquid Expanding Vapor Explosion. (slide V-31-32)

D. Option (if time allows) Show film/video "BLEVE" (25 min.)

E. 10-Minute Break

Section of Student Outline Relating to Section V

V. EXPLOSIVES AND COMPRESSED GASES

Draw the placards for explosives (indicate color).

The possible hazards of explosives are:

1. blast-over pressure
2. shock waves
3. scattering fragments
4. additional fires

The recommended evacuation distances for explosives are:

Class A - 1 mile

Class B - 1/2 mile

Class C - 1500 feet

Draw the placards for compressed gases (indicate the colors) (flammable, non-flammable)

The possible hazards of compressed gases are:

1. BLEVE (Boiling Liquid Expanding Vapor Explosion)
2. Explosion
3. Asphyxiation
4. Toxicity
5. Corrosiveness
6. Frost bite
7. Reactivity

Define the term BLEVE:

B - Boiling

L - Liquid

E - Expanding

V - Vapor

E - Explosion

Questions Relating to Explosives and Compressed Gases

BLEVE is a hazard most commonly associated with:

a. pressurized flammable liquid gas containers

b. flammable solids

c. explosives

d. aluminum gasoline cargo tanks

BLEVE is an acronym for:

a. Bring local evacuation vessels to emergency

b. Boiling liquid expanding vapor explosion

c. Blast leveling every victim everywhere

d. Boiling liquid exploding vapor escape

The possible multiple hazards of non-flammable gases include:

a. toxicity

b. explosion

c. asphyxiation

d. "a" and "c" only

e. all of the above

VI. CHARACTERISTICS OF HAZARDOUS MATERIALS

(flammable liquids, flammable solids, oxidizers, organic peroxides and poisons)

A. Lecture/slides - Flammable Liquids (20 min.)

B. Lecture/slides - Flammable Solids (10 min.)

C. Lecture/slides - Oxidizers, Organic Peroxide (10 min.)

D. Lecture/slides - Poison (15 min.)

E. Break (5 min.)

STUDENT OBJECTIVES - MINIMUM COMPETENCIES/SKILLS

1.3 Describe the chemical and physical properties of flammable liquids, flammable solids, oxidizers, organic peroxides, and poisons.

1.5 Recognize and identify the basic hazardous materials containers for flammable liquids, flammable solids, oxidizers, organic peroxides, and poisons.

2.1 Identify the hazards to health and safety created by hazardous materials emergencies.

3.2 Explain the risk assessment considerations to be made by first responders at a hazardous materials incident, with special attention to the limitations of first responders due to lack of specialized protective clothing, equipment and training.

3.4 Explain the rescue considerations of first responders at a hazardous materials incident involving flammable liquids, flammable solids, oxidizers, organic peroxides, and poisons.

3.5 Explain the evacuation considerations of first responders at a hazardous materials incident involving flammable liquids, flammable solids, oxidizers, organic peroxides, and poisons.

3.6 Explain the isolation and containment considerations of first responders at a hazardous materials incident involving flammable liquids, flammable solids, oxidizers, organic peroxides, and poisons.

3.7 Explain the environmental considerations to be made at a hazardous materials incident involving flammable liquids, flammable solids, oxidizers, organic peroxides, and poisons.

VI. CHARACTERISTICS OF HAZARDOUS MATERIALS
(flammable liquids, flammable solids, oxidizers, organic peroxides)

A. Lecture with slides - Flammable Liquids (20 min.)

1. Definitions

Flammable liquids are defined as liquids which give off flammable vapors that ignite on contact with open flame, sparks, or hot metal surfaces. (slide VI-1)

To better understand the characteristics and behavior of flammable liquids, some examination of terminology is necessary.

Flash point is the lowest temperature at which a flammable liquid will give off sufficient vapors to burn if in contact with an ignition sources. Remember - it is the vapor that burns, not the liquid. (slide VI-2)

A liquid may reach its flash point without being at its ignition temperature. The removal of the ignition source from a liquid at its flash point will cause the fire to go out. (slide VI-3)

If the liquid is at its ignition temperature point and producing vapors, ignition will produce an on-going combustion until the fuel is consumed.

As a flammable liquid emits vapors, these vapors mix with the surrounding air to form an ignitable mixture.

When there is not enough fuel to mix with the air, the mixture is said to be "too lean" to burn.

The flash point of a liquid is that temperature which causes enough vapor production to reach the lower part of the flammable range. (slide VI-4)

The flash points, ignition temperatures and flammable ranges of different flammable liquids are only approximations. Many factors may cause them to change.

When a flammable liquid has been spilled or is leaking, the entire flammable range is present.

Such vapors are heavier than air and travel in patterns that may be deceiving, without the aid or specialized equipment, responders may not be able to detect the presence of flammable vapors.

Another term important to the understanding of flammable liquids is specific gravity: the weight of a material as compared to the weight of an equal volume of water. (slide VI-5)

Most flammable liquids are lighter than water. Gasoline is an example. Gasoline will float on water.

D.O.T. placards distinguish between flammable and combustible liquids. Flammable liquids have flash points below 100 degrees F: combustible liquids have flash points above 100 degrees F and below 200 degrees F. (slide VI-6)

Examples of flammable liquids are acetone, gasoline. toluene amd methyl ethyl ketone. (slide VI-7)

Diesel fuel, kerosene and fuel oil are examples of combustibles. (slide VI-8)

2. Principle Hazards

Accidents involving flammable liquids are often spectacular and often result in a large number of injuries and deaths. (slide VI-9)

The large number of these incidents which occur each year make flammable liquids a major concern to communities and to those required to respond to emergencies.

Responders must be aware of the possible hazards associated with flammable liquids and act accordingly.

The principle hazards of flammable liquids are: (slide VI-10)

a. Fire
b. BLEVE
c. Combustion explosion
d. Toxicity or corrosiveness
e. Reactivity
f. Contamination of water

3. Detection

Flammable liquids are easily located throughout a community and the most commonly found of all the classes of hazardous materials. (slide VI-11)

Roughly 60% of all the hazardous materials transported though Arizona are flammables.

In transportation, these red placards identify flammable and combustible liquids. (slide VI-12)

Containers for the transportation of flammable and combustible liquids include plastic and metal containers. (one gallon to 55 gallon drums), cargo tanks and rail rank cars. (slide VI-13)

Fixed facilities may have containers holding one gallon such as at K-Mart to several thousand gallons at a tank farm.

Such containers are usually low pressure vessels that have venting mechanisms to relieve undue pressures. (MC 306)

If the liquid pressurizes quickly in such containers, violent ruptures can occur - just as in containers of pressurized gases.

4. Incident Objectives

Due to the danger of BLEVE's, combustion explosions, fires and toxicity, evacuation should be one of the initial actions taken and appropriate protective clothing and respiratory protection must be utilized. (slide VI-14)

In some cases, evacuation may involve all response personnel as well as the public.

In many situations, evacuation is a law enforcement function. Officers must be aware of the complexities and difficulties involved in evacuating the public, especially when the dangers are not understood. Law enforcement officials must assure that their personnel will be adequately protected before entering a hazardous area. Respiratory protection not commonly available to law enforcement may be needed. (slide VI-15)

Command must consider the availability of shelters, the manning of shelters, transportation, notification, the needs of the elderly or handicapped and security for the evacuated area.

First responders must be aware of pollution and contamination resulting from flammable liquid spills - especially to water supplies. (slide VI-16)

Certain containment methods might be utilized to minimize or prevent environmental damage and to slow, stop or redirect the spread of the hazard. (slide VI-17)

Before first responders initiate any containment actions, they must first assess their risk of exposure and their ability to protect themselves and others. Adequate product information is essential to determining the level of risk.

Preventing environmental damage must be second to the safety of all.

The basic containment methods are: (slides VI-18 & 19)

1. Dams - barriers built to hold back flowing water or material

2. Dikes - use of an absorbent material or impervious material to stop, slow or redirect the movement of a spilled material

3. Absorption - use of any material that is capable of absorbing several times its own weight in hazardous materials (sand, dirt, sawdust, pads, mats, etc.)

4. Isolation - intentionally diverting a spilled material into a section of storm drain (must have map of storm drains)

5. Diverting - using available methods and materials to turn a spilled material from one area and/or course or travel to another

6. Covering - utilizing a compatible material spread over a spilled material to prevent the spilled material from vaporizing or becoming airborn (to include fire fighting foam)

7. Containerizing - placing leaking containers into overpack drums

8. Plugging & patching - using available equipment & materials to control leaks

In the case of flammable liquids when a fire has not yet occured, several methods of containment may be appropriate depending on circumstances: dams, dikes, absorption or covering. Use of a water fog may be required to disperse vapors. (slide VI-20)

First responders should not attempt any of these methods of containment without adequate product information, proper protective clothing and training.

In summary, remember the red flammable and combustible placards. The possible multiple hazards of flammables and combustibles are: (slide VI-21-22)

1. Fire
2. BLEVE
3. Combustion explosion
4. Toxicity or corrosiveness
5. Reactivity
6. Contaminate water supply

Protect all involved by distance, safety precautions (remove all sources of ignition), proper protective clothing, respiratory protection - CAUTION.

B. Lecture with slides on flammable solids (10 min.)

1. Definition

A flammable solid is any solid material, other than an explosive, that is liable to cause fire through friction or retained heat from manufacturing a processing, or that can be ignited readily, and when ignited burns at high temperatures and are difficult to extinguish. (slide VI-23)

2. Principle Hazards

The possible multiple hazards of flammable solids are: (slide VI-24)

1. Ignite easily and burn explosively
2. Air reactive
3. Water reactive
4. Spontaneously combustible
5. Toxicity and corrosiveness

Water reactive means that the material can become spontaneously combustible (ignite by itself) if it comes in contact with water or humid air.

Sodium is an example. Sodium releases hydrogen when in contact with water - releasing sufficient heat to cause an explosion.

Air reactive (pyrophoric) materials will ignite at normal temperatures when exposed to air.

Spontaneously combustible flammable solids will catch fire when exposed to air, phosphorus will ignite with air at or above 86 degrees F. producing high irritating, slightly toxic fumes.

3. Detection

Flammable solids are found in a variety of locations in communities. (slide VI-25)

For example, white phosphorus (an air reactive) is used in the manufacturing of matches and rat poison.

Calcium carbide (a water reactive) is a source of acetylene and used in fertilizer manufacturing. (slide VI-26)

In transportation, red and white striped placards identify flammable solids. (slide VI-27)

For water reactive materials the placard includes a blue triangle with a white "slash W". This symbol indicates water should not be used. (slide VI-28)

Phosphorus and sodium are the two main flammable solids found in transport. Both are usually shipped in hermetically sealed drums or cans.

4. Incident Objective

Responders must be extremely cautious when responding to incidents involving these materials. (slide VI-29)

Of particular concern is that water reactive flammable solids may give off flammable or toxic gases. For example, calcium carbide releases acetylene gas when water is applied. Acetylene is extremely flammable, forming an explosive mixture with air.

Phosphorus can cause severe burns and can be fatal if inhaled.

Responders must handle these materials carefully and should wear full protective clothing.

C. Lecture with slides on oxidizers and organic peroxides (10 min)

1. Definition - Oxidizers

An oxidizer is a substance that yields oxygen readily to stimulate combustion. Oxidizers accelerate the burning of other materials. (slide VI-30)

2. Possible Hazards - Oxidizers

The possible multiple hazards of oxidizers are: (slide VI-31)

a. supply oxygen
b. sensitive to heat, shock, friction
c. react with organic matter spontaneously
d. form ignitable mixture

When involved in fires, oxidizers may explode in mass. Exposure of these materials to organic matter can result in explosion or ignition.

Oxidizers such as ammonium nitrate is capable of undergoing detonation if heated under confinement or subjected to strong shocks.

In addition, when these materials are involved in fires, the fumes may be toxic.

3. Detection - Oxidizers

Oxidizers have a wide variety of uses and may be found in a number of locations in a community. (slide VI-32)

For example, nitric acid is used in fertilizers, explosives and in etching metals.

Potassium and sodium nitrate are used in metal heat treating and in fertilizers.

Ammonium per sulfate is used in bleaches and dyes.

A yellow placard identifies an oxidizer in transportation (slide VI-33)

Common containers include bags, fiberboard or metal drums

4. Definition - Organic Peroxides

Organic peroxides, like oxidizers, support the burning of combustible materials (slide VI-34)

5. Possible Hazard - Organic Peroxides

The possible multiple hazards of organic peroxides are: (slide VI-35)

a. highly flammable
b. sensitive to heat shock, friction
c. releases heat
d. toxic

Organic peroxides such as benzoyl peroxide and peracetic acid are derivatives of hydrogen peroxide which can be unstable and sensitive to heat.

Some may self-ignite if they come in contact with many common materials.

6. Detection - Organic Peroxides

Organic peroxides are used in the production of plastics (benzoyl peroxide and lauroyl peroxide). (slide VI-36)

Peracetic acid is used as a fungicide and as a sterilizing agent.

Certain bleaching peroxides are used in bleaching flour.

An yellow placard is used to identify organic peroxides in transportation. (slide VI-37)

Some organic peroxides are shipped under refrigeration.

7. Incident Objectives

If the refrigeration fails, the product may decompose - releasing heat sufficient to ignite or explode.

When oxidizers or organic peroxides are involved in accidents, use extreme caution.

Without experience, adequate product information, training and protective gear, intervention should not be attempted.

D. Lecture with slides on poisons (15 min.)

1. Definition

Poisons are substances - liquids, solids or gases - which are toxic to humans, plants and animals. (slide VI-38)

2. Principle Hazards - Poisons

The hazards of poisons range from Poisons "A" - such as arsine, hydrocyanic acid or phosgene - where breathing just a small amount may kill you. (slide VI-39)

To poison "B" which are so poisonous as to present a health threat to humans.

Irritants, such as tear gas can cause discomfort but usually not permanent injury or death.

Etiologic agents are germs or toxins that could cause diseases in humans

3. Detection

Distinct placards identify Poisons "A" (slide VI-40)

Poisons "B" (slide VI-41)

and Irritants (slide VI-42)

Etiologic agents are labeled as they are transported in small quantities and packages (slide VI-43)

Due to the agricultural activity in Arizona, pesticides (Poisons "B") are common.

In addition to the DOT placards and labels for Poisons "B", signal words will appear in each package or container containing a pesticide.

DANGER - means highly toxic

WARNING - means moderately toxic

CAUTION - means slightly toxic (slide VI-44)

Responders in agricultural areas should become familiar with the types of pesticides being stored and used in their area. They should also become familiar with the locations where pesticides are used and stored. (slide VI-45)

4. Incident Objectives

Due to the agricultural activity in Arizona, pesticides are a major concern to responders - especially those in the rural areas of the state. (slide VI-46)

Pesticides are classified as Poisons "B". In addition to being toxic, some pesticides are also flammable.

The basic concerns of personnel involved in a pesticide incident are: (slide VI-47)

a. contamination
b. poisoning
c. fire

Full protective clothing must be worn to prevent hazardous chemicals from entering the body. A few drops of some of these chemicals can kill. Waterproof gloves and boots which will not absorb the product must be used. Leather soled shoes, for example, will absorb poisons. (slide VI -48)

There should be no chance of skin exposure or eye exposure.

Respiratory protection must also be provided. Fumes and smoke from pesticide fires can be extremely toxic.

If water is used to fight a pesticide fire, the run-off water will be contaminated. Construct dikes to prevent further contamination. (slide VI-49)

In some cases the use of dry chemicals, foams or water fog may be more effective for fires involving pesticides.

Pesticides contain organophosphates and carbamates. Both function as cholinesterase inhibitors. (slide VI-50)

Cholinesterase is a vital enzyme found in nerve tissue. When this enzyme is tied up by pesticides, much of the nervous system can no longer function properly.

Victims may experience headaches, respiratory distress, vomiting, diarrhea, blurred vision. (slide VI-51)

The pupils will be constricted and the heart rate will slow.

Common organophosphates found in fertilizer plants and warehouses are: diazinon, malathion, parathion, TEPP and phosdrin. (slide VI-52)

Common carbamate insecticides are: banal, sevin and landrin.

If victims are involved in the incident, responders must assess their risk of exposure before attempting rescue. (slide VI-53)

Responders must not become part of the problem

If responders or others are exposed to pesticides, two simultaneous actions are critical:

Begin decontamination of the victims (slide VI-54)
All clothing must be removed by personnel in protective clothing.

Copious amounts of water should be used to wash the victims, flushing the skin thoroughly. (slide VI-55)

Thorough decontamination must be completed before patients are transported. (slide VI-56)

If not, transport vehicles and personnel could also become contaminated.

In addition to victims, all clothing, tools, equipment and vehicles must be cleaned and decontaminated thoroughly.

Do not take the problem home or to the fire or police station.

Responders should be monitored following such incidents for possible signs of poisoning. (slide VI-57)

Notify local medical facilities that pesticide poisoning victims will be arriving. (slide VI-58)

Contact should be made with the area's poison control center for assistance. (slide VI-59)

In Arizona, poison centers are located at the University of Arizona in Tucson and at St. Luke's Medical Center Phoenix. (see handout) (slide VI-60)

VI. FLAMMABLE LIQUIDS, FLAMMABLE SOLIDS, OXIDIZERS, ORGANIC PEROXIDES AND POISONS

Terms to know:

Flammable - liquids that give off flammable vapors that ignite on contact with open flame sparks on hot metal surfaces, the flashpoint is below 100 F.

Combustible - liquids that have flash points above 100 degrees and below 200 degrees F

Flash point - the lowest temperature at which a flammable liquid will give off sufficient vapor to burn if in contact with an ignition source

Ignition temperature - the minimun temperature (F) required to initiate or cause self-sustained combustion.

Specific gravity - the weight of a material as compared to the weight of an equal volume of water

The major hazards of flammable liquids are:

1. Fire
2. BLEVE
3. Combustion explosion
4. Toxicity
5. Corrosiveness
6. Reactivity
7. Contamination of water

Draw the placards for flammable and combustible liquids (indicate color).

The basic containment methods are:

1. dams
2. dikes
3. absorption
4. isolation
5. diverting
6. covering
7. containerizing
8. plugging and patching

Draw the placards for flammable solids (indicate colors).

Draw the placard for oxidizers and organic peroxides (indicate colors).

The possible hazards of flammable solids are:

1. Ignite easily and burn explosively
2. Air reactive
3. Water reactive
4. Spontaneously combustible
5. Toxicity and corrosiveness

The possible hazards of oxidizers are:

1. supply oxygen
2. sensitive to heat, shock, friction
3. react with organic material spontaneously
4. form ignitable mixture

If responders or others are exposed to pesticides or other poisons two simultaneous actions are critical:

1. Begin decontamination
2. Notify medical facilities

In Arizona, poison centers are located in:

1. Phoenix
2. Tucson

Draw the placards for poison: (indicate color)

When found on a container of pesticide, these words mean:

DANGER - highly toxic

WARNING - moderately toxic

CAUTION - slightly toxic

Test Questions Relating to Section VI

The Lower Flammable (Explosive) Limit is defined as:

a. the minimum concentration of vapor in air or oxygen below which propagation of flame does not occur on contact with a source of ignition.

b. the maximum proportion of vapor or gas in air above which propagation of flame does not occur.

c. the range below which ignition cannot occur without preheating of vapors.

d. none of the above

The Department of Transportation "Placard", which is red and white vertically striped, identifies what hazard class:

a. flammable solid

b. dangerous

c. poison gas, poison

d. radioactive

The letter "W" with a horizontal line through the center (W) appearing in a Department of Transportation "Placard" or on the NFPA Fire Diamond indicates a material that will:

a. explode

b. neutralize in water

c. react with water

d. dissolve in water

The Department of Transportation "Placard", which is yellow in color, identifies what hazard class:

a. oxidizer, organic peroxide

b. flammable gas, liquid, combustible

c. explosives

d. flammable solids

The Department of Transportation "Placard", which is white in color, identifies what hazard class:

a. explosives

b. flammable solid

c. poison, poison gas

d. non-flammable gas

Flammable liquids:

a. have a flash point below 100 degrees F

b. are spontaneously combustible

c. have a flash point above 100 but below 200 degrees F

d. have a flash point above 200 F but below 300 degrees F

VII. CHARACTERISTICS OF HAZARDOUS MATERIALS
(Corrosives, Radioactives, Other Regulated Materials)

A. Lecture with slides - corrosives (10 min.)

B. Lecture with slides - radioactive, other regulated materials (10 min.)

C. Summary (10 min.)

STUDENT OBJECTIVES - MINIMUM COMPETENCIES/SKILLS

1.3 Describe the chemical & physical properties of corrosives and radioactive materials.

1.5 Recognize & identify the basic hazardous materials containers for corrosives and radioactive materials.

2.1 Identify the hazards to health and safety created by hazardous materials emergencies.

3.2 Explain the risk assessment considerations to be made by first reponders at a hazardous materials incident, with special attention to the limitations of first responders due to lack of specialized protective clothing, equipment & training.

3.4 Explain the rescue considerations of first responders at a hazardous materials incident involving corrosives and radioactive materials.

3.5 Explain the evacuation considerations of first responders at a hazardous materials incident, involving corrosives and radioactive materials.

3.6 Explain the isolation & containment considerations of first responders at a hazardous materials incident, involving corrosives and radioactive materials.

3.7 Explain the environmental considerations to be made at a hazardous materials incident, involving corrosives and radioactive materials.

VII. Characteristics of Hazardous Materials
(Corrosives, Radioactives, Other Regulated Materials)

A. Lecture with slides - corrosives (10 minutes)

1. Definition

A corrosive material is any liquid or solid that can destroy human skin tissue, or any liquid that has a severe corrosion rate on steel. Corrosives include acids and bases. (slide VII-1)

2. Possible Multiple Hazards

Corrosives present multiple hazards: (Slide VII-2)

a. Contact or inhalation can destroy living tissue

b. Violent ruptures can occur

c. Corrosives can splatter in contact with water (keep a safe distance if applying water)

d. Vapors of corrosive materials, such as phosphorus trichloride and oleum, may be poisonous or extremely irritating: Respiratory protection is necessary.

Some fumimg corrosives will react violently with water.

3. Detection

Corrosives are used widely in chemical processing, manufacturing and many high tech industries.

Acids such as nitric acid may be used in a wide variety of functions: fertilizers, explosives, metal etching. (slide VII-3)

Bases such as sodium hydroxide and potassium hydroxide are used in the production of soap.

A black and white placard and label is used for corrosives in transit. (slide VII-4)

Packages for corrosive materials include carboys, metal kegs, cargo tanks, and tank cars. (slide VII-5)

4. Incident Objectives

Responders must take all precations to avoid contact with corrosives.

Both skin and respiratory protection are necessary.

The consequences of exposure to corrosives can be devastating (slide VII-6)

If corrosive materials come in contact with the body, water should be applied <u>immediately</u> in large quantities to wash the material away.

B. Lecture with slides - radioactives, other regulated materials (10 minutes)

1. Definitions

A radioactive material is any material that spontaneously emits ionizing radiation. (slide VII-7)

2. Possible Hazards

Radiation exists in 3 forms: (slide VII-8)
alpha
beta
gamma

Alpha and beta particles are not powerful enough to penetrate the layers of the skin but they do present hazards. They can produce ulceration of the skin and during fire conditions, these particles may become attached to the particulate matter of smoke. (slide VII-9)

If such particles are inhaled (ingested), alpha and beta radiation can cause internal damage.

Gamma radiation passes through the body and can cause irreversible damage. Lead is the only effective shield against gamma radiation. Distance is the best safety precaution for responders faced with such a threat.

3. Detection

Radioactive material such as iodine and cobalt, are used in medical treatments. (slide VII-10)

Enriched uranium is used as a fuel element in nuclear power plants.

Most radioactive material shipments are in small packages such as radiopharmaceuticals. Although some rail shipments are found in lead-shielded casks on special rail cars. (slide VII-11)

Military shipments of radioactive materials may also be encountered on the highways. (slide VII-12)

The Department of Transportation classifies and labels radioactive materials based the amount of radiation in a package.

Radioactive I - less than .5 milliroentgen per hour (slide VII-13)
Radioactive II - less than 10 milliroentgen per hour
Radioactive III - less than 200 milliroentgen per hour

If radiation exceeds 200 milliroentgen per hour, DOT requires special containers & packaging.

In Arizona, contact the Arizona Radiation Regulatory Agency for special assistance and information regarding radioactive materials. (slide VII-14)

4. Other Regulated Materials

Other regulated materials often called ORM's are materials that require appropriate packaging & handling in transportation. (Slide VII-15)

ORM "A" materials, like dry ice & carbon tetrachloride, have anesthetic, irritating, noxious, or other properties creating extreme annoyance or discomfort to passengers or crew in the event of leakage during air or water transportation.
(slide VII-16)

ORM "B" materials, like metallic mercury and copper chloride, are corrosive to aluminum. Leaks may cause significant damage to aircraft during transportation. (slide VII-17)

ORM "C" materials, such as oakum & bleaching powder, have characteristics which make them unsuitable for water shipment unless properly identified.
(slide VII-18)

ORM "D" materials are consumer commodities which present a limited hazard during transportation. (slide VII-19)

ORM D are small quantities of certain hazardous materials packaged for commercial sale. (slide VII-20)

ORM "E" materials are hazardous substances or wastes, not otherwise classified as hazardous. Examples are pentachlorophenol and adipic acid. They pose a threat to the environment. (slide VII-21)

By now, you realize that there is a wide variety of hazardous materials. Many of these hazardous materials have multiple dangers.

C. Summary (10 min.) Lecture with slide

During this course we have looked at how you can detect the presence of hazardous materials, how you can use reference materials to identify hazardous materials, how to protect yourself and we have looked at some of the characteristics of each class. We have warned that you not attempt intervention unless you are able to protect yourself and others.

Now we want to give you some specific guidelines developed by the State Hazardous Materials Training Committee to help you make decisions about your involvement in a hazardous materials incident.

The state committee recommends that First Responders attempt to handle only certain types of incidents; (slide VII-23)

1. materials known/identified
2. normal firefighting turnouts and SCBA's available
3. N.F.P.A. - 704M: 2or 1 rating
4. Direct contact with material will not adversely affect responder
5. NO Poison A, Flammable Solids - Water Reactives, Radioactives III, Explosives A and B
6. No victims
7. No adverse environmental impact

First Responders should resist intervention and call for help if any of these conditions are exceeded.

SECTION FROM STUDENT OUTLINE RELATING TO SECTION VII

CORROSIVES, RADIOACTIVES, OTHER REGULATED MATERIALS

Draw the placard for corrosives: (indicate color)

The possible hazards for corrosives are:

1. destroys living tissue
2 violent ruptures can occur
3. can splatter in contact with water
4. vapors may be toxic or irritating

If corrosives comes in contact with the body, apply/wash with large amount of water immediately.

Radiation exists in three forms:

1. alpha
2. beta
3. gamma

Gamma radiation is the most hazardous.

Draw the placards for radioactive materials (indicate color)

Guidelines for First Responder intervention at hazardous materials incidents:

1. materials known/identified
2. normal firefighting turnouts and SCBA's
3. N.F.P.A. 704M: 2 or rating
4. Direct contact with material will not adversely affect responder
5. No Poison A, Flammable Solids - Water Reactive, Radioactives III, Explosives A & B
6. No victims
7. No adverse environmental impact

Which form of radiation can pass through the body and cause irreversible damage?

a. beta
b. gamma
c. alpha
d. all three can pass through the body

The Arizona State Hazardous Materials Training Committee recommends that First Responders not consider intervention at a hazardous materials incident when:

a. N.F.P.A. 704M: 2 or 1 rating
b. There is no adverse environmental impact
c. when Explosives A and B are involved
d. when Poison B is involved

VIII. PLANNING & SCENE MANAGEMENT

A. Lecture/transparencies on planning (15 minutes)

B. Lecture/transparencies on scene management (15 minutes)

STUDENT OBJECTIVES - MINIMUM COMPETENCIES/SKILLS

4.1 Describe federal, state and local government resources available for hazardous materials emergencies in Arizona.

4.2 Describe private agencies and facilities available for hazardous materials emergencies in Arizona.

4.3 Explain the importance of pre-emergency planning for hazardous materials incidents.

4.4 Explain the importance of coordination between the multible agencies involved in hazardous materials response.

4.5 Describe the correct procedures for accessing additional resources.

3.8 Describe local hazardous materials procedures.

VIII. PLANNING AND SCENE MANAGEMENT

A. Lecture with slides (15 minutes)

In order for a community or business be prepared for any kind of hazard, it must plan. This is no less true for hazardous materials emergencies. Not only must we plan for response to emergencies but we must also plan for the other phases of emergency management:

For any size jurisdiction or facility, the management of hazardous materials encompasses a multi-faceted approach utilizing 4 phases: (slide VIII-1 and 2)

1. Mitigation - activities which eliminate or reduce the occurrence of future disasters (inspections).

2. Preparedness - planning for response (training, hazard analysis, planning).

3. Response - activities related to the actual response to limit the primary effects of a disaster.

4. Recovery - activities required to return all systems to normal.

ASK STUDENTS TO GIVE EXAMPLES OF ACTIVITIES FOR EACH PHASE.

Communities and business must consider all four phases when assessing their capability to manage hazardous materials. Mitigation and planning activites are of critical importance. Eliminate and/or reduce the possibility of disasters when possible and plan for the response and recovery phases in the event of disasters.

Two steps are critical in pre-emergency planning: (slide VIII-3)

1. hazard analysis
2. resource identification

A hazard analysis helps you: (slide VIII-4)

1. Know what to expect.
2. Set goals and priorities.
3. Make decisions about resources and budgets.
4. Identify level of commitment.

Learn what threatens your community or your work place.

Ask these questions: (slide VIII-5)

1. What chemicals are used, stored or moved through my community or work place? Where are they?

2. How are the chemicals contained, transported and stored? In what quantity?

3. How are the chemicals used?

4. What routes of travel are used? What is the frequency of movement?

5. What can these chemicals affect if there is an unintentional release?

Visit fixed facilities using and storing hazardous materials. Develop pre-plans for each facility in case response is required. Work with the industry representatives to learn about their facilities, processes and specific product information.

Inspections of facilities may also reveal code violations, safety hazards or other problem areas that can be remedied to mitigate accidents.

Once you understand the problems you face, you can identify the resources you will need to respond to emergencies. (slide VIII-6)

Resources which would be required to handle any kind of hazardous materials incident must be identified. Some of these will be available in the community; some will not. An accurate, up-to-date, accessible resource listing is critical to a community's plan. Consider resources needed for all four phases.

You should ask these questions: (slide VIII-7)

1. Who can provide the needed resources for response, recovery, preparedness and mitigation of hazardous materials incidents?

2. How do we access these resources? mutual aid?

3. Who is responsible? Who has authority? Who is in command?

For local jurisdictions and governmental agencies, there are resources available from the state to assist responders statewide with hazardous materials problems.

In case of emergencies, contact the Department of Public Safety Duty Officer at 262-8212. (slide VIII-8)

DPS can provide hazardous material response assistance and can access other state resources which may be required.

The Arizona Department of Health Services can provide emergency response and recovery assistance when the public health or environment is threatened.

The Arizona Division of Emergency Services can assist with planning and training.

In situations where federal assistance may be required, the appropriate state agency will make the contact.

For private industry, talk to your local response agencies. Know who to call and what they can do for you

All persons (all departments, agencies, private resources) who might become involved in a hazardous materials incident must be included in the planning process. In a typical community, these would include the fire department, police department, public works, volunteer agencies, providers (pre-hospital and hospital), elected officials and producers, users and transporters of hazardous materials. As we consider all phases of hazardous materials management, (response, recovery, preparedness & mitigation), the required resource and agency list becomes extensive.

A community must ask to what extent it can afford to be prepared to handle hazardous materials emergencies. The expense of equipment, training and personnel can be prohibitive. The State Hazardous Materials Training Committee has identified:

First Responder
Equipment costs (per engine company) $100.00 (slides VIII-9, 10)
Training hours (per person) 8-40 hours

Intermediate
Equipment costs (per engine company) $5,000-8,000 (slides VIII-11,12,13,14)
Training hours (per person) 160 hours (approx)
(includes First Responder training)

Advanced
Equipment costs (per engine company) unlimited (slides VIII-15,16)
Training hours (per person) 307 hours (approx)
(includes First Responder and intermediate Level training)

Few communities can afford advanced or even intermediate levels of response for hazardous materials. Such communities can provide a high level of protection nonetheless by good planning.

INSTRUCTOR SHOULD ASK STUDENTS ABOUT THEIR LOCAL PLANS - OR IF TEACHING FOR A SPECIFIC BUSINESS OR COMMUNITY, REFERENCE THE LOCAL PLAN OR CONTINGENCY PLAN.

B. Lecture with slide (15 minutes)
Incident Command/Scene Management

Initial Actions

Generally speaking, there are two phases of activities for the first responder who is confronted by a hazardous materials accident. The first phase is the set of activities that should be undertaken enroute to an accident: and the second phase is the set of tasks that should be accomplished shortly after the first responder reaches the scene. (slide VIII-17)

Enroute (slide VIII-18)

1. Ask for and make note of weather information (wind speed and direction)
2. Ask if hazardous substance has been identified
3. Review any available pre-emergency plans
4. Seek additional resources if necessary

At the Scene

Once the first responder arrives, he should place himself upwind/upgrade. Give an on-scene report and take command. In the on-scene report, the first responder should give this information (as a minimum): (slide VIII-19)

1. conditions at the scene (fire, vapor cloud, leaking drums, overturned gasoline truck, etc.)
2. routing and positioning (staging) direction if appropriate
3. request for additional resources (as needed)

If the first responder to the scene wants to place other responders or personnel out of danger, he should give them routing and positioning (staging) directions. In other words, if the first responder at the scene feels that conditions might worsen or that a certain area at the scene is extremely dangerous, then he should place other responders (and himself) out of harm's way. First responders must use common sense and avoid becoming part of the problem.

Once a responder reaches the scene, he should call for additional resources, if it is clear that the resources that are on the way will be inadequate to cope with the emergency. Such resources must be able to: (slide VIII-20)

1. isolate the area
2. stabilize the scene
3. decontaminate and treat victims
4. protect property and the environment
5. evacuate the surrounding area, if necessary

Critical to the response to any emergency or disaster is the immediate establishment of an on-scene command system. Management system procedures must be implemented to control personnel, facilities, equipment and communication - to implement the plan and to provide for the safety of all personnel.

A command system will also assure the coordination of multiple responding agencies, of resources and of media releases as an incident escalates.

Sectorization

One of the most effective ways of establishing a strong, viable command system is to sectorize. Sectorization utilizes the concept of "divide and conquer". In other words, it allows a complex situation to be broken down into managable parts that are called sectors. Each sector is assigned a supervisor, thus reducing the span of control for command.

Basic Types of Sectors (slide VIII-21)

There are 2 basic types of sectors:

1. geographical
2. functional

The geographical sector divides an incident into territories such as North Sector, South Sector, East Sector and West Sector: or it may divide a 3 story building into level 1, level 2, level 3 and roof sectors. Within each geographical sector, the assigned officer or supervisor will be given certain objectives such as rescue, crowd control, fire control, salvage, etc. and the resources in order to carry out these objectives. The supervisor of a sector will decide the tactics to be employed to carry out these objectives. In other words, he will assign the tasks that are necessary to realize the objectives of his sector.

A functional sector has very specific objectives that are usually the same anytime that this sector is used. In other words, the difference between a geographical sector and a functional sector is that objectives are assigned to a geographical sector based upon need, while the objectives of a functional sector are more predetermined. Some examples of a functional sector are: (slide VIII-22)

1. evacuation
2. extrication (rescue)
3. treatment
4. transportation
5. hazardous
6. safety
7. lobby control
8. traffic control
9. crowd control

Once Command has established the hazardous sector and has given approval to their plan of action, he must then ensure that the proper support sectors are in place to assist the hazardous sector. Once he has accomplished this (and usually this can be accomplished by using existing sectors), Command will continue to coordinate the effort of all sectors involved in the operation and to provide any resources that are needed.

Small departments should recognize that a sector may only be one person. No matter how small the responding unit or how limited available resources, a system to manage the incident must exist.

Ask students to identify the procedures they use in their communities or workplace.

Sections of Student Outline for:

VIII. PLANNING AND SCENE MANAGEMENT

Emergency activities are divided into four phases that bear on emergency events. The four phases are:

1. Mitigation

2. Preparedness

3. Response

4. Recovery

Define the following terms:

Mitigation - Activities which eliminate or reduce the occurence of future disaster.

Preparedness - Planning for response.

Response - Activities related to the actual response to limit the primary effects of a disaster.

Recovery - Activities required to return all systems to normal.

The first step in pre-emergency planning is hazard analysis.

When state assistance is required at the scene of a hazardous materials incident, responders should call the Arizona Department of Public Safety Watch Commander at 262-8212.

List two steps necessary for developing pre-emergency plans:

1. Hazard analysis

2. Resource identification

When enroute to a hazardous materials incident, responders should:

1. Ask for wind direction and speed.

2. Ask for hazardous substance has been identified.

3. Review any available pre-emergency plans.

4. Seek additional resources if necessary.

At the scene the first responder should make sure adequate resources are on the way to cope with the emergency. Such resources must be able to:

1. Isolate the area.
2. Stabilize the scene.
3. Decontaminate and treat victim.
4. Protect property and environment.
5. Evacuate the surrounding area.

The two basic types of sections are:

1. Geographical
2. Functional

The responsibilities of first are to:

1. Establish command/control (scene management).
2. Detect the presence of hazardous materials.
3. Begin identification.
4. Evacuation.
5. Decontamination/personnel protection.
6. Isolate incident/identify zones of activity.
7. Contain incident if possible from an isolated position without risk of exposure.
8. Seek additional appropriate resources.

According to the film "First on the Scene", the five key points to remember when responding to a hazardous materials accident are:

1. Approach cautiously
2. Identify hazards
3. Secure site
4. Obtain help
5. Site entry?

Test Questions Relating to Section VIII and IX.

A command system:

a. ensures the safety of public safety and other responding personnel

b. provides a system which assures the coordination of agencies and resources as an incident escalates

c. provides a structure in which the responsibilities for a variety of functions can be divided among several people.

d. all of the above

The first two steps in developing pre-emergency plans are:

a. contact DPS and the Arizona Division of Emergency Services

b. resource identification and traffic routing

c. contact all agencies involved and write plan

d. hazard analysis and resource identification

In the event that state resources are required to respond to or recover from a hazardous materials incident, local response agencies should notify immediately:

a. the Arizona Division of Emergency Services

b. the local Sheriff

c. the Arizona Department of Public Safety, Duty Officer

d. the Arizona Department of Health Services

Prior to taking action to stabilize the incident, it is imperative that the first arriving emergency unit:

a. determine what hazardous material(s) is involved and how much
b. apply master streams to suppress fire in/on containers
c. close valves and place containers in an upright position
d. none are correct

The first arriving emergency unit at a hazardous material incident will establish Command, begin size-up, and:

a. rescue the injured
b. gain fire control
c. dike and contain the materials
c. slow down, and evaluate effects of wind, topography and location of the situation and avoid commitment to a dangerous situation

IX. SUMMARY AND REVIEW

A. Videotape (25 min.)

B. Summarize key points (5 min.)

C. Test (30 min.)

D. Student evaluation (10 min.)

Sections Objectives

1. Summarize the roles and appropriate actions of first responders.

2. Administer post test and student course evaluations.

IX. SUMMARY/REVIEW

A. Videotape (25 min.)

Introduce videotape "First-on-the-Scene" (Chemical Manufacturer's Association)

This tape will summarize the roles and responsibilities of those "first-on-the-scene" and will summarize the key points of the course.

Play videotape

B. Summarize key points of film (5 min.) (slide)

1. approach cautiously
2. identify hazards
3. secure site
4. obtain help
5. site entry?

Summarize the responsibilities of a first responder as explained in Section I

C. Administer post test (30 min.)

D. As soon as students complete the post test, have them fill out the student evaluation forms. (10 min.)

Student Outline

1. **INTRODUCTION**

The role of the first responder or anyone "first at the scene" of a hazardous materials incident is to protect life and property. The first responder accomplishes this crucial task by doing the following:

1. Establish command/control (scene management).
2. Detect the presence of hazardous materials.
3. Begin identification.
4. Evacuation.
5. Decontamination/personnel protection.
6. Isolate incident/identify zones of activity.
7. Contain incident if possible from an isolated position without risk of exposure.
8. Seek additional appropriate resources.

Essential attitudes for first responders are:

1. Hazardous Materials incidents are not like routine calls.
2. Every responder must be realistic about capabilities and limitations.
3. The primary responsibility of every first responder is to promote safety for all.
4. Coordinate and cooperate with all agencies responding to hazardous materials incidents.

Define the term "hazardous materials."

D.O.T.- any substance or material in a quantity or form which poses an unreasonable risk to health, safety and property when transported in commerce.

Benner - any substance that jumps out at you when something goes wrong and hurts or harms the things it touches.

II. DETECTING THE PRESENCE OF HAZARDOUS MATERIALS

A process for decision-making at hazardous materials incidents has been described by Ludvig Benner with the mnemonic D.E.C.I.D.E. This stands for:

D - detect presence of hazardous materials

E - estimate likely harm

C - choose response objective

I - identify action options

D - do best option

E - evaluate progress

Clues for detecting the presence of hazardous materials.

1. Occupancy/location
2. Container shapes
3. Markings and colors
4. Placards and labels
5. Shipping papers
6. Detection devices
7. Your senses

111. REFERENCE MATERIALS - IDENTIFYING HAZARDOUS MATERIALS

There are two primary identification systems used in the U.S. for hazardous materials - the NFPA system for marking buildings and the Department of Transportation (DOT) system for marking vehicles and containers and packages in transportation.

The NFPA has a Fire Diamond divided into four sections. Each section is a different color and indicates a specific type of hazard. The four sections and the color associated with each are:

1. Blue - Health
2. Red - Flammability
3. Yellow - Reactivity
4. White - Special information

Each color section is marked numerically to include order of severity of hazard:

Health Section - Blue

a) 4 - under normal conditions or fire conditions are extremely hazardous (i.e., toxic or corrosive) through inhalation, contact or absorption
   "special clothing only"

b) 3 - serious temporary or residual injury on short exposure
   "special clothing only"

c) 2 - continued exposure could cause injury
   "full clothing"

d) 1 - irritation or minor injury

"full clothing"

e) 0 - ordinary hazard

"full clothing"

Flammability Section - Red

a) 4 - very flammable bases or very volatile flammable liquids. Fire fighting stages include shutting off flow and cooling tanks or containers.

b) 3 - can be ignited under almost all normal temperature conditions. Low flash point may make ineffective.

c) 2 - must be moderately heated before ignition will occur. Water will cool.

d) 1 - must be preheated before ignition will occur. Water will cool.

e) 0 - will not burn.

Reactivity Hazards Section - Yellow

a) 4 - readily capable of detonation or explosive reaction at normal temperatures and pressures. Sensitive to shock. Evacuate area if advanced stages of fire.

b) 3 - requires initiation source or heat to explode.

c) 2 - will chemically change, but not detonate. May react violently with water.

d) 1 - normally stable, but becomes unstable with heating.

e) 0 - normally stable even under fire conditions.

The white section denotes special hazards:

a) possible hazard of using water, reactive with water.

b) "P" self-reacting of polymerize

c) Radioactivity

d) "OXY", oxidizing agents, yields oxygen readily to simulate or support combustion to the point that they will burn with savage intensity. Organic peroxides will probably explode if involved in a fire.

The NFPA defines full protective clothing as:

Full protective clothing means protection to prevent gases, vapors, liquids, and solids from coming in contact with the skin. Full protective clothing includes the helmet, self-contained breathing apparatus, coat and pants customarily worn by fire fighters (turn-out or bunker coat and pants), rubber boots, gloves, bands around legs, arms and waist, and face mask, as well as covering for neck, ears and other parts of the head not protected by the helmet, breathing apparatus or face mask.

The NFPA defines special protective clothing as:

Special protective clothing refers to clothing specially designed to protect against a specific hazard. Special protective clothing is recommended for those chemicals with a health hazard rating of 4.

The nine categories of hazardous materials under the United Nations Classification System:

1. Explosives
2. Gases
3. Flammable Liquids
4. Flammable Solids
5. Oxidizers and Organic Peroxides
6. Poisons
7. Radioactives
8. Corrosives
9. Miscellaneous

DOT placards are diamond shaped - 10-3/4" square. They provide information on hazardous materials in four ways.

1. Color
2. Numbers
3. Symbols
4. Words

When using the 1984 DOT Emergency Response Guidebook, if you fail to identify the material involved by either name or ID number, you should use Guide II.

IV. PERSONNEL PROTECTION AND SAFETY

The main mechanisms of harm can be recalled with the mnemonic TRACEM which stands for:

T - Thermal

R - Radiation

A - Asphyxiation

C - Chemical

E - Etiological

M - Mechanical

Four ways by which hazardous materials can invade your body:

1. Inhalation
2. Skin absorption
3. Ingestion
4. Injection

Before emergency personnel should attempt rescue at a hazardous materials incident, they must consider:

1. Rescuer protection
2. Victim contamination
3. Decontamination

V. EXPLOSIVES AND COMPRESSED GASES

Draw the placards for explosives (indicate color).

The possible hazards of explosives are:

1. Blast-over pressure

2. Shock waves

3. Scattering fragments

4. Additional fires

The recommended evacuation distance for explosives are:

Class A - 1 mile

Class B - 1/2 mile

Class C - 1500 feet

Draw the placards for compressed gases(indicate the colors)

(flammable, non-flammable)

The possible hazards of cf compressed gases are:

1. BLEVE (Boiling Liquid Expanding Vapor Explosion)
2. Explosion
3. Asphyxiation
4. Toxicity
5. Corrosiveness
6. Frost bite
7. Reactivity

Define the term BLEVE:

B - Boiling

L - Liquid

E - Expanding

V - Vapor

E - Explosion

Terms to know:

Explosion - A rapid chemical transformation producing large quantities of heat and gases, exerting high pressure on the environment.

Cryogenic - Liquified gases with temperatures below -150^F.

Flammable Range- The range of a gas or vapor concentration in air that will burn or explode if an ignition source is present.

Lower Explosive Limit (LEL) - The minimum concentration of vapor in air below which propagation of flame does not occur on contact with a source of ignition.

Upper Explosive Limit (UEL) - The maiximum concentration of vapor in air above which propagation of flame does not occur on contact with source of ignition.

VI. FLAMMABLE LIQUIDS, FLAMMABLE SOLIDS, OXIDIZERS, ORGANIC PEROXIDES, AND POISONS

Terms to know:

Flammable - Liquids which give off flammable vapors that ignite on contact with open flame, sparks or hot metal surface, the flash point is below 100^F. Combustible - Liquids that have flash points above 100^ and below 200^F.

Flash point - The lovest temperature at which a flammable liquid will give off sufficient vapor to burn if in contact with an ignition source.

Ignition temperature - The minimum temperature (F^) required to ignite gas or vapor without a spark or flame being present.

Specific gravity - The weight of a material as compared to the weight of an equal volume of water.

The major hazards of flammable liquids are:

1. Fire
2. BLEVE
3. Combustion explosion
4. Toxicity
5. Corrosivesness
6. Reactivity
7. Contamination of water

Draw the placards for flammable and combustible liquids (indicate color).

The basic containment methods are:

1. Dams
2. Dikes
3. Absorption
4. Isolation
5. Diverting
6. Covering
7. Containerizing
8. Plugging and patching

Draw the placards for flammable solids (indicate colors).

Draw the placard for oxidizers and organic peroxides (indicate colors).

The possible hazards of flammable solids are:

1. Ignite easily and burn explosively
2. Air reactive
3. Water reactive
4. Spontaneously combustible
5. Toxicity and corrosiveness

The possible hazards of oxidizers are:

1. Supply oxygen
2. Sensitive to heat, shock, function
3. React with organic material spontaneously
4. Form ignitable mixture

If responders or others are exposed to pesticides or other poisons two simultaneous actions are critical:

1. Begin decontamination
2. Notify medical facilities

In Arizona, poison centers are located in:

1. Phoenix
2. Tucson

Draw the placards for poison: (indicate color)

When found on a container of pesticide, what do these words mean?

DANGER - highly toxic

WARNING- moderately toxic

CAUTION- slightly toxic

VII. CORROSIVES, RADIOACTIVES, OTHER REGULATED MATERIALS

Draw the placard for corrosives: (indicate color)

The possible hazards for corrosives are:

1. Destroys living tissue
2. Violent ruptures can occur
3. Can splatter in contact with water
4. Vapors may be toxic or irritating

If corrosives come in contact with the body, immediately apply/wash with large amounts of water.

Radiation exists in three forms:

1. Alpha
2. Beta
3. Gamma

Gamma is the most hazardous radiation.

Draw the placards for radioactive materials: (indicate color)

Guidelines for first responder intervention at hazardous materials incidents:

1. Materials known/identified
2. Normal firefighting turnouts and SCBA's
3. N.F.P.A. 704M: 2 or 1 rating
4. Direct contact with material will not adversely affect responder
5. No poison A, Flammable Solids Water Reactive, Radioactivities III, Explosives A and B
6. No victims
7. No adverse environmental impact

VIII. PLANNING AND SCENE MANAGEMENT

Emergency activities are divided into four phases that relate to emergency events. The four phases are:

1. Mitigation
2. Preparedness
3. Response
4. Recovery

Mitigation - Activities which eliminate or reduce the occurrence of future disasters

Preparedness- Planning of response

Response - Activities related to the actual response to limit the primary effects of a disaster

Recovery - Activities required to return all systems to normal

When state assistance is required at the scene of a hazardous materials incident, responders should call the Arizona Department of Public Safety Watch Commander at 262-8212.

Two steps necessary for developing pre-emergency plans:

1. Hazard analysis
2. Resource identification

When enroute to a hazardous materials incident, responders should:

1. Ask for wind direction and speed.
2. Ask if hazardous substance has been identified.
3. Review any available pre-emergency plans.
4. Seek additional resources if necessary.

At the scene the first responder should make sure adequate resources are on the way to cope with the emergency. Such resources must be able to:

1. Isolate the area.
2. Stabilize the scene.
3. Decontaminate and treat victim.
4. Protect property and environment.
5. Evacuate the surrounding area.

The two basic types of sections are:

1. Geographical
2. Functional

The responsibilities of first responders are to:

1. Establish Command/Control (Scene management)
2. Detect the presence of hazardous materials
3. Begin identification
4. Evacuation
5. Decontamination/personnel protection
6. Isolate incident/identify zones of activity
7. Contain incident if possible from an isolated position without risk of exposure
8. Seek additional appropriate resources

According to the film "First on the Scene", the five key points to remember when responding to a hazardous materials accident are:

1. Approach cautiously
2. Identify hazards
3. Secure site
4. Obtain help
5. Site entry?